LOWER CLEARWATER

AQUATIC MAMMAL SURVEY

FINAL REPORT

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EXECUTIVE SUMMARY

The Bonneville Power Administration provided funding under contract number DE-BI79-90BP12073 to collect baseline data on river otters to assist in developing mitigation implementation plans for river otters percent to the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, sections 1003 (b) (2) and (3). Distribution, movements, habitat use, and diets of river otters were investigated in the Clearwater River within the Nez Perce Indian Reservation from 1991-1992.

Distribution of river otters was assessed using three different methods. A mail survey was distributed to initially assimilate the collective, common knowledge of otter habitats and populations in the drainage. In addition, an intensive survey for otter sign along the entire length of the mainstem Clearwater River and the lower 5 km of tributary streams, within the study area, was conducted to acquire more specific information on distribution of otters in the study area. Finally, river otter latrine site surveys were conducted throughout the duration of the project to monitor seasonal changes in otter distribution in the study area.

Information we gathered suggested river otters were found uniformly throughout the drainage including the study area, with population centers occurring along the main rivers (Clear-water, Lochsa, and Selway), the upper South Fork Clearwater drainage including Red River, Lo10 Creed drainage, and the Potlatch River. Of 67 questionnaires 26 respondents supplied 40 reports regarding information on otter habitat conditions and population status for 18 different reaches, and 70 reports of sightings of otters or their sign in the Clear-water River drainage. Questionnaire participants indicated good otter habitat existed throughout the drainage. Otters were considered common residents with stable or increasing populations found throughout the drainage. Reports of otter sightings were received from all three rivers and larger tributaries in the drainage. A search of 256 km of shoreline documented sign of river otters throughout the study area including 50 latrine sites. Latrine sites were distributed throughout the study area and more than 78% of sites remained active during all seasons of the year.

Home range length and consecutive-day movements of river otters were evaluated using radio location data collected from instrumented animals. Home range length was estimated for each instrumented otter by measuring the length (km) of river and tributaries encompassed within the furthest downstream and upstream locations. Mean consecutive-day movements were estimated for each instrumented otter by averaging straightline distances moved between all consecutive daily locations.

Male otters in the Clearwater River moved extensively, while female otters tended to limit their movements to small sections of the river. Male otters maintained larger home ranges and moved greater daily distances than females during all seasons of the year. Mean home range length for male otters was 106.3 km, compared to 25.5 km for females. Mean consecutive-day movement for males was 11.6 km, compared to 2.0 km for females. Home range lengths of male and female otters showed little seasonal variation. A trend toward larger spring and summer home range lengths, compared to fall and winter, was observed for male otters. Home range lengths tended to be smaller in winter and spring than summer and fall for female otters. Increased movements observed for males during the spring and summer probably was related to adult males seeking breeding females. Minimum spring and maximum fall movements observed for adult female otters was probably related to those females being tied closely to the natal den area during early pup rearing, and increasing their movements as the pups developed through summer and fall. River otters in the Clearwater River exhibited extensive inter- and intrasexual home range overlap.

Our results suggested the Clearwater River within the Reservation boundaries does not encompass an entire population of otters. Although the study area appears to support a core number of breeding otters, it is evident there is substantial interchange among other population centers within the drainage. Movements of instrumented otters strongly suggested regular interchange between otters in the Clearwater River with otters in the Selway and Lochsa Rivers, and the upper tributaries of Lo10 Creek and the Potlatch River. Although instrumented otters rarely ventured into the South Fork of the Clearwater, we suspected there was some interchange between otters in the Clearwater River and otters in the South Fork and its tributaries, particularly Red River.

In assessing habitat use of the Cleat-water River by river otters, we: 1) characterized available river otter habitats, 2) characterized den sites used by otters, 3) characterized latrine sites used by otters, and 4) determined selection of available habitats by otters in the study area. Shorelines along the Clearwater River are dominated by rocky substrates. Over 70% of shoreline substrates are composed of either gravel and cobbles (36%) or riprap (35%). Sandy or organic soil substrates compose only 5% of the shoreline. Generally, sparse or unvegetated habitat categories accounted for approximately 75% while dense habitat categories accounted for only 25% of all bank vegetation. Although 63% of all vegetation along the Clearwater River had tree overstories, about half were scattered trees and over 69% supported sparse understories. Shrub overstories accounted for most of the remainder of the vegetation along the river with sparse shrub overstories predominating (87%).

Instrumented river otters used 124 different dens during the course of the study. River otters in the Cleat-water River used more (63%) rock cavities than any other den type. Railroad (24.2%) and highway (19.4%) riprap, natural rock (19.4%), and vegetation (12.9%) were the most common den types. The most common bank substrate and vegetation associated with otter den sites were unvegetated and sparse shrub overstory with sparse herbaceous understory vegetation categories associated with large highway and railroad riprap substrate types.

Most latrine sites were located in eddies (66%) along either convex (52%) or straight (26%) shorelines of either mainstem (n = 36) or side channel slough (n = 10) habitats of the Clearwater River. Haul-outs to latrine sites were mostly shallow (< 50 cm) with flat contours below the waterline (64%) and either shallow sloping (50%) or steep sloping (28%) banks. Sign of beaver activity was observed at over 60% of documented latrine sites. More than half (58%) of documented latrine sites were located in either sand or large riprap bank substrates. Otter latrine sites were associated with a variety of vegetation categories; the two most frequent were sparse shrub overstory with sparse herb understory and unvegetated. Bank vegetation at latrine site located on sandy substrates was mostly (77%) either dense shrub or dense herbaceous. Latrine sites located on rocky substrates were mostly (75%) associated with either no or sparse vegetation. Hiding cover was low at all latrine sites regardless of bank substrate or vegetation. Visibility at 1.5 m from latrine sites was greater than 50% at 82% of the sites. Visibility at 4.5 m from latrine sites was greater than 75% at 74% of the sites.

Our assessment of habitat use by river otters in the Clearwater River suggested otters chose denning and latrine sites based on the suitability of bank substrates more than other habitat parameters. Of the four most common substrates comprising 86% of all available substrates, gravel and cobble were avoided and natural rock and large riprap were preferred. Although sand occurs infrequently in the study area, it was used greater than expected. Use of bank vegetation was variable and no patterns were discernable. For all otters combined, 1 1 of 17 bank vegetation categories were used significantly more or significantly less than expected. Of the 20 different bank vegetation categories, 57% of all radio locations of otters were in only two categories: scattered tree overstory with sparse shrub understory and sparse shrub overstory with sparse herb understory. These two vegetation categories were also the two most abundant vegetation category and both were used greater than expected.

River otter scat was collected during radiotracking efforts and monthly latrine site surveys from January - December 1992. Diet composition of river otters was determined by identifying all prey remains found in collected scat. The relative proportion each prey item contributed to the overall diet was determined by the frequency each item was found across all samples. Fish. invertebrate, bird, and mammal prey remains were identified. Fish comprised 79% of all identified prey items. Crayfish was the only invertebrate identified and also comprised a substantial (20%) proportion of the sample. Birds (0.4%) and mammals (0.06%) were considered infrequent prey items of otters in the Cleat-water drainage.

When considering only identified fish families, catostomids were most frequently recorded comprising 42% of all identified fish species. Salmonidae was the next most frequently recorded fish family, comprising 27% of identified fish prey remains. Cottidae (13%), Cyprinidae (10%), and Centrarchidae (8%) were recorded less frequently. Although crayfish were observed in only 24% of the scats sampled, they ranked second in frequency of occurrence behind suckers (33%) with salmonids comprising the third most frequent (21%) prey item, when considering proportions of fish and crayfish in the sample.

diets of otters foraging in the Potlatch River differed from those foraging in the Clear-water River. and seasonal changes in diets occurred for otters foraging in both rivers.

Shoreline habitats along the mainstem Clearwater River are characterized by long reaches of non-habitat punctuated by isolated pockets of otter habitat. These "insular habitats" may be vital in maintaining otter numbers in the study area as otters keyed in on these areas for foraging, denning, grooming, and pup rearing. Insular habitats occurred where bank substrates were suitable for denning sites. Otters in the Clearwater River chose den sites based on the suitability of bank substrates, more than any other habitat variable measured during this study. The availability of suitable bank substrates may be an important habitat consideration in limiting the number of otter den site in the study area. The two suitable bank substrates used for denning by otters in the study area were rock and organic. Although most (88.4%) shorelines were rocky, only approximately 16% of the study area contained suitable rock substrates for otter den sites. Organic bank substrates occurred in only 5% of available shoreline the study area.

Large tributaries are important habitats for otters in providing year-round habitat, movement corridors for maintaining interchange between other sub-populations in the drainage, and important natal den and pup rearing habitats. Although small tributaries in the study area received very little year-round use by otters, they may be used for natal den areas by female otters during the breeding season.

The study outlined recommendations to help guide development of mitigation implementation plans for riparian habitats in the Clearwater River corridor. Based on the findings of this study, we identified and prioritized sections of the Clearwater River within the study area, that if protected or enhanced would provide optimal benefit to otters: We also outlined habitat improvement alternatives which could by used to enhance otter habitats. The Recommended priority for selecting waterways for mitigation measures was tributary streams, side channel and backwater sloughs, mainstem river, and island habitats.

INTRODUCTION

HISTORY AND BACKGROUND

Since the construction of the Bonneville Dam in 1938, the construction and operations of hydroelectric power production facilities in the Columbia River Basin have had profound impacts on fish and wildlife resources. In 1980 Congress directed that measures to protect, mitigate, and enhance fish & wildlife populations and habitats to the extent affected by the development and operation of hydropower projects in the Columbia River drainage be implemented through the passage of The Pacific Northwest Electric Power Planning and Conservation Act (Public Law 96-501). This Act created the Northwest Power Planning Council, which in turn developed the Columbia River Basin Fish & Wildlife Program (CRBFWP) (Northwest Power Planning Council 1987). The CRBFWP, Sections 1003(b) (2) and (3), provides the framework for developing wildlife habitat loss assessments and mitigation plans for identified hydropower projects in the Columbia River system.

Dworshak Dam, a federal hydropower facility constructed across the North Fork Clearwater River and located within the Nez Perce Indian Reservation was one of the projects identified in the CRBFWP. An interagency work group consisting of the Nez Perce Tribe, United States Corps of Engineers, United States Fish and Wildlife Service, United States Forest Service, Idaho Department of Lands, Idaho Department of Fish and Game, and Bonneville Power Administration, completed the loss assessment and mitigation plan for Dworshak Dam in 1989 (Meuiman et al. 1989). The Nez Perce Tribe and State of Idaho subsequently entered into an agreement with Bonneville Power Administration securing funding mechanisms, for implementing mitigation measures, through the creation of wildlife mitigation trust funds (Bonneville Power Administration 1992).

Because it is closely tied to riparian habitats, the river otter was chosen by the interagency work group to represent the impacts of hydropower production on aquatic mammals and was used as an indicator species for modelling the losses of riverine and riparian habitats along the North Fork Clearwater River. Loss assessments estimated that 4,614 acres of river otter habitats were lost due to the construction of the Dworshak project and subsequent inundation of the North Fork of the Clearwater River.

The interagency work group also recommended a study to provide baseline information on population status, habitat use, and food habits of river otters in the Clearwater River corridor for the purpose of acquiring information needed to identify stream reaches with riparian habitats, important to river otters, to be protected and/or enhanced through mitigation efforts. To address these concerns and to fulfill the requirements of Measures 1003 (b) (2) and (3) of the CRBFWP the Lower Clearwater Aquatic Mammal Survey (Intergovernmental Agreement DE-BI79-90BP12073, Project 90-51) was initiated in September 20, 1990.

JUSTIFICATION AND PURPOSE

The increasing aesthetic, or nonconsumptive, value of river otters to recreationists is evident through the state-wide ban on trapping for otters and the current state of Idaho management guidelines for otters (Will and Leptich 1993). The importance of river otters to the Nez Perce Tribal culture and customs is well documented (Nez Perce Tribe, internal reports). Ecologically, the river otter is closely associated with aquatic and riparian habitats and serves as an important component in maintaining the Clearwater River drainage ecosystem.
Although river otters were known to inhabit the Clearwater River drainage, site specific information available on river otter ecology, habitat use, food habits, or population size within the Clearwater drainage is lacking. The occurrence of river otters has been well established through Idaho Department of Fish and Game trapping records and frequent personal accounts received by natural resource agencies. Asherin and Orme (1978) also reported supplemental observations of otters or otter sign during their wildlife inventory survey along the lower Clearwater River.

Tabor et al. (1980) studied the impacts of hydropower facility modification and river regulation on riparian habitats and associated wildlife along the lower, mainstem Columbia River. Evidence of river otter activity was limited to the lower Columbia from below Bonneville Dam up to and including John Day Pool, and Tabor did not address habitat use of otters in this area.

Melquist and Hornocker's (1983) study of river otters inhabiting the Payette River drainage in central Idaho provided many insights into river otter ecology in a riverine system. However, habitat differences between the Payette and Clearwater drainages suggest different habitat use patterns by river otters.

Baseline information on otter habitat use of the Clearwater River was needed to develop an effective mitigation plan. The purpose of this project was to identify habitats important to river otters in the Clearwater River. The results of this study will help to insure the most effective and efficient use of the Nez Perce Dworshak Wildlife Mitigation Trust Fund in designing and implementing future mitigation projects aimed at protection and enhancement of riparian and riverine habitats.

GOALS AND OBJECTIVES

Project goals included:

1) Determine extent and distribution of river otter use of the lower Clearwater River,
2) identify stream reaches with otter activity which could be targeted for protection, and
3) identify stream reaches with limiting habitat components which could potentially be enhanced and/or protected.

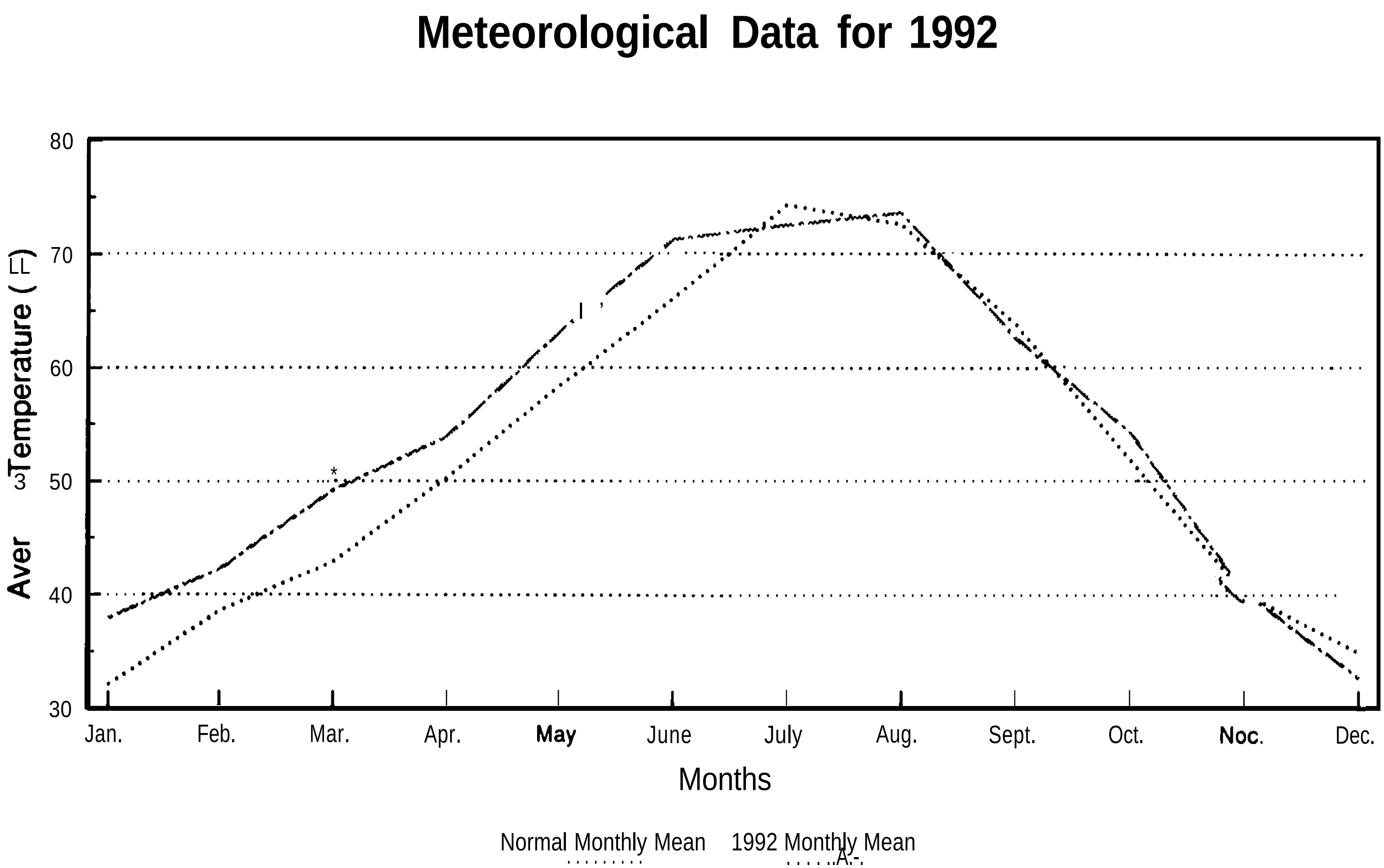
To accomplish project goals, the following objectives were identified:

1) Determine distribution and movements of river otters along the lower Clearwater River corridor and its tributaries and quantify the amount of otter use in specific reaches and streams,
2) determine habitat use patterns for river otters along different stretches of the Clearwater River corridor, and
3) determine seasonal food habits for river otters within the Clearwater River corridor and its tributaries.

STUDY AREA DESCRIPTION

The Clearwater River basin drains approximately 9,600 square miles of north central Idaho (Kronemann 1987). The upstream tributaries begin near the summits of the Bitterroot Range in steep mountainous terrain characterized by dense spruce fir forests. The drainage flows generally westward, decreasing in elevation into dry, open, grassy hills and cultivated plateaus. The climate at the upper elevations is characterized by mild summers and long cold winters. Snow is common from early fall through late spring. In contrast, the climate in the lower end of the drainage is characterized by hot, dry summers and mild winters with infrequent snow accumulation. The area is dominated by moist maritime air masses moving over the area from the Pacific Ocean by prevailing westerly winds. Mean annual temperatures range from less than 32" F at the highest elevations to 50' F at the lowest elevations. Mean annual precipitation ranges from 80 inches in the upper Bitterroot Mountain Range to 17 inches at the mouth of the Clearwater River (U.S. Army Corps of Engineers 1975).

Climatic conditions were unseasonably mild during the first winter and spring of the study. Mean monthly temperatures during 1992 were above normal means from January through June (National Oceanic and Atmospheric Administration 1992) (Fig. 1).



Fig, **1. Average normal (based on 1951-1980 record period) monthly mean temperatures and monthly mean temperatures recorded in the study area** in **1992, Cleatwater River, Idaho (National Oceanic and Atmospheric Administration, Lewiston weather station).**

Mild temperatures coupled with little precipitation, accounted for unusually low snowpack and less ice formation along the rivers and streams in the upper reaches of the drainage during the winter of 1991-1992.

Asherin and Orme (1978) found that riparian habitats along the Clearwater River within the study area had a linear orientation due to State Highway 12 and the Camas Prairie Railroad line running from Lewiston to Kooskia. This narrow strip of riparian habitat consisted primarily of rock riprap, but supported more developed vegetation where the highway or railroad drew away from the edge of the river.

Coyote willow (Salix exigua) was the most abundant riparian shrub found along the river bank. Xeric mixed deciduous shrub, annual forb, and ponderosa pine (Pinus ponderosa)lcheatgrass brome (Bromus tectorum) vegetation types were all common. Gravel and cobble bars were the most common, while roadfill and rock riprap were the second most predominate bank substrates.

The study area encompassed approximately the lower half of the Clearwater River drainage, including the portion of the Clearwater River within the Nez Perce Indian Reservation from the slack water of Lower Granite Dam near the mouth of the Clearwater River at Lewiston, Idaho, upstream to the confluence of the South Fork Clearwater River near Kooskia, Idaho (Fig. 2).

The study area was subdivided into lower and upper river sections. The lower Clearwater River section included the Clearwater River and its tributaries from the mouth of the Clearwater River, at the town of Lewiston, upstream to the confluence with the North Fork Clearwater River, at the town of Orofino. The upper Clearwater River section included the Clearwater River and its tributaries from the confluence with the North Fork Clear-water River at the town of Orofino, upstream to the confluence of the South Fork Clearwater River at the town of Kooskia.

The topography of the lower Clearwater River section is characterized by cultivated plateaus bisected by steep canyons. The Clearwater River in this section is broad and shallow with some braided channel reaches and infrequent side channels and backwater sloughs. River flows in this section are influenced by the operation of Dworshak Dam. The canyon walls are steep, open, grassy slopes leading to vast agricultural fields on the plateaus above.

The river in the unregulated upper river section narrows and is composed of a single channel with a steeper gradient, and rocky shorelines. Open, grassy, slopes give way to sparse to dense timber stands, depending on slope and aspect, along with scattered rolling benches and farm lands. Above the river canyon there is a mix of timber, farm, and pasture lands.

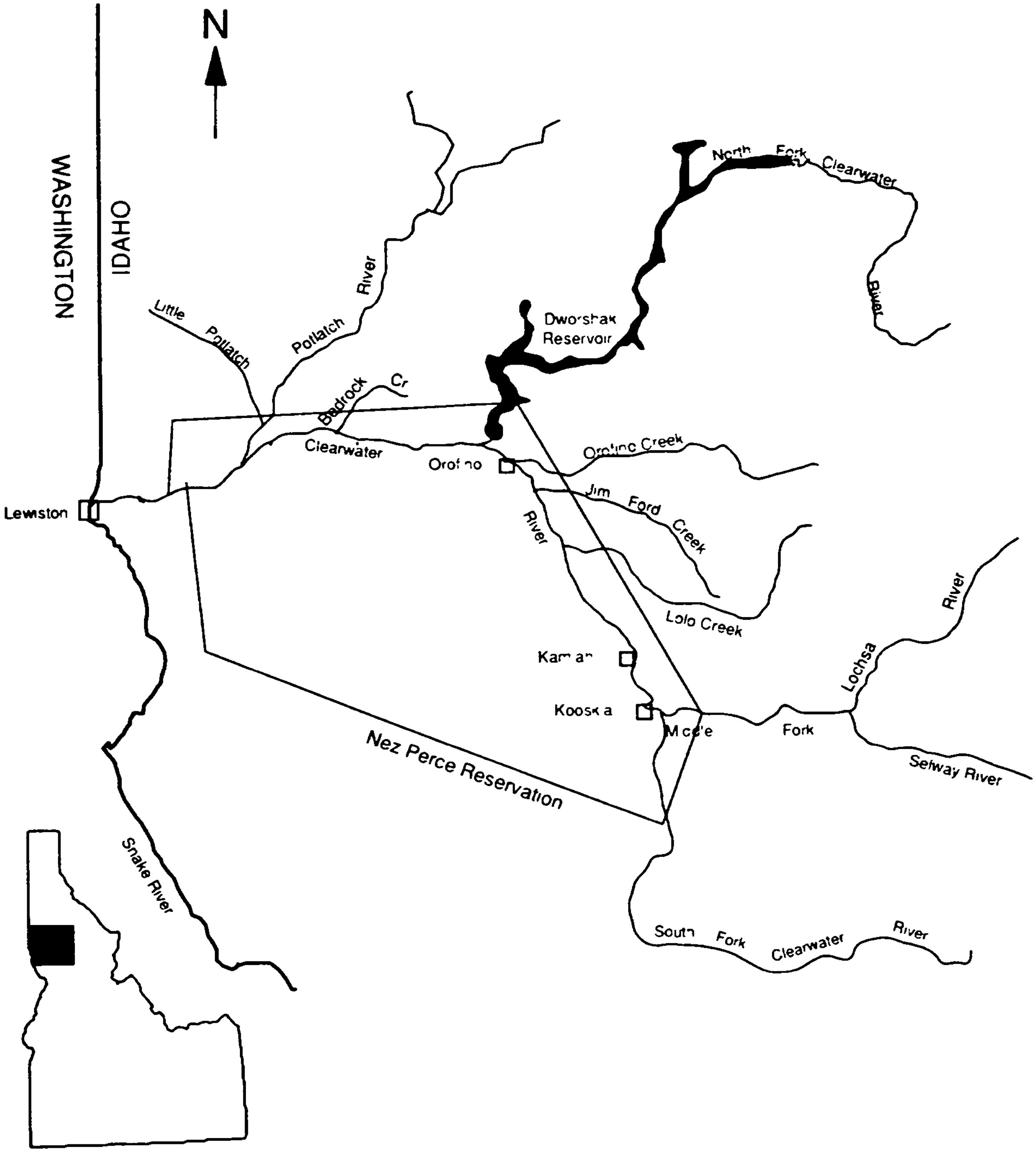


Fig. 2. Map of the study area showing the Clearwater River within the Nez Perce Indian Reservation including the lower river section below, and the upper river section above Orofino, Idaho.

HANDLING TECHNIQUES

INTRODUCTION

Otters are extremely susceptible to capture myopathy, or stress induced death syndrome. Capture myopathy continues to be the major cause of otter mortality in studies requiring capturing and handling river otters (Erickson et al. 1984, Mack 1985, McDonald 1989, Jalkotzy, Logdson, Lauzon, Glinski pers. commun.) . Chronic stress develops through the accumulative effects of many acute stressors associated with capture and handling activities which include noise; prolonged exposure to inclement environmental conditions; lack of proper food, water, or care while in captivity; physical trauma; infection; and fright. If precautions are not taken, the animal's condition will steadily deteriorate and treatment is usually unsuccessful (Spreaker 1982).

The best remedy is stress prevention through use of efficient handling techniques. Standard capture and handling techniques rely on physically restraining the animal. Physical restraint of animals is a major contributor to chronic stress. This chapter describes non-restraining techniques designed and used during this study to capture and handle river otters.

METHODS

Trapping and Handling

Modified hancock livetraps (Hancock Trap Co., Custer, South Dakota 57730) were used to capture river otters in the Clearwater River. Otters were captured during two spring (26 March - 10 June, 1991 and 24 March - 2 April, 1992), and one fall (23 September - 27 November, 1991) trapping seasons. Both wet (basket of trap placed below waterline) and dry (trap set above waterline) sets were used along otter trails (trail sets) and at latrine sites (latrine sets). Additionally, otter lure was used on some sets.

To minimize stress to captured otters, project personnel developed handling techniques that required no physical restraint or contact with the animals. Captured otters were transported in the trap to holding facilities. Otter and trap were carried from the trap site to an awaiting vehicle using a canvas stretcher (Fig. 3). The stretcher was made of 18 oz. untreated cotton canvas and measured 106 cm long by 84 cm wide. A top flap, slightly larger than the bottom, covered the trap and quieted the animal. The stretcher was wetted to provide evaporative cooling for the animal.

At the holding facility, the trap was coupled with a door specifically designed to transfer the animal into a holding pen. Only one animal was housed in each of three available pens. Each pen measured 1.5 m wide, 2 m long, and 2.5 m tall.

A multi-purpose handling box was designed as a den, transportation, and anesthesia box (Fig. 4). Handling boxes were constructed of 3/4 inch plywood and measured 81 cm long, 30 cm wide, and 33 cm tall. The handling box had a metal sliding door, 11 vent holes 2 cm in diameter in each side, and a plexiglass top. A second removable plywood top was fitted over the plexiglass top. One handling box was placed in each pen and a pulley system set up to allow the sliding door to be operated from outside the pen. Captured otters used the handling box as a den box, which they readily entered upon approach of caretakers. To maintain the pens and care for captured animals, otters-were easily secured inside the handling box by closing its sliding door. Otters were similarly secured and transported in their handling boxes to the veterinarian for implant surgery.

Surgery

Dr. Clarence Binninger DVM, of Lewiston, ID. surgically implanted radio transmitters in the first five captured otters. Dr. Duane Wolverton DVM of Orofino, ID. performed implant surgery on seven additional otters. Implant surgery procedures followed those outlined by Mack (1985). Otters were presented for surgery in a ventilated handling box (described above). To determine the proper anesthetic dose, a preliminary weight of the otter was determined by weighing the handling box containing the otter and subtracting the known weight of the box. The handling box was then used as an anesthesia chamber by occluding all but two vent holes with masking tape. One vent hole was left open for an exhaust, and the other was fitted with a connecting hose to the anesthetic vaporizer, to administer the anesthetic.

The first 5 otters were anesthetized with Isoflorane, but this anesthetic was proven unacceptable for river otters. Otters induced with Isoflorane recovered within seconds from being released from the anesthetic chamber, making it impossible to intubate the animal. Since an intermuscular injection could be administered very quickly, otters induced with isoflorane were administered a mean dose of 0.09 ml/kg Tiletamine Hydrochloride Aolaze Pam Hidrochloride (Telasol®) to produce a surgical plane of anesthesia. This procedure was abandoned because both anesthetics were unpredictable when used on otters.

The remaining captured otters were anesthetized with Halothane. Halothane was administered at a flow of 5-10 liters per minute at a 5% gas concentration. When the otter was quiet, flow continued at 5 liters per minute and 3% gas concentration for several minutes to allow time for the anesthetic to saturate into body tissues. Once the otter was induced, the anesthesia

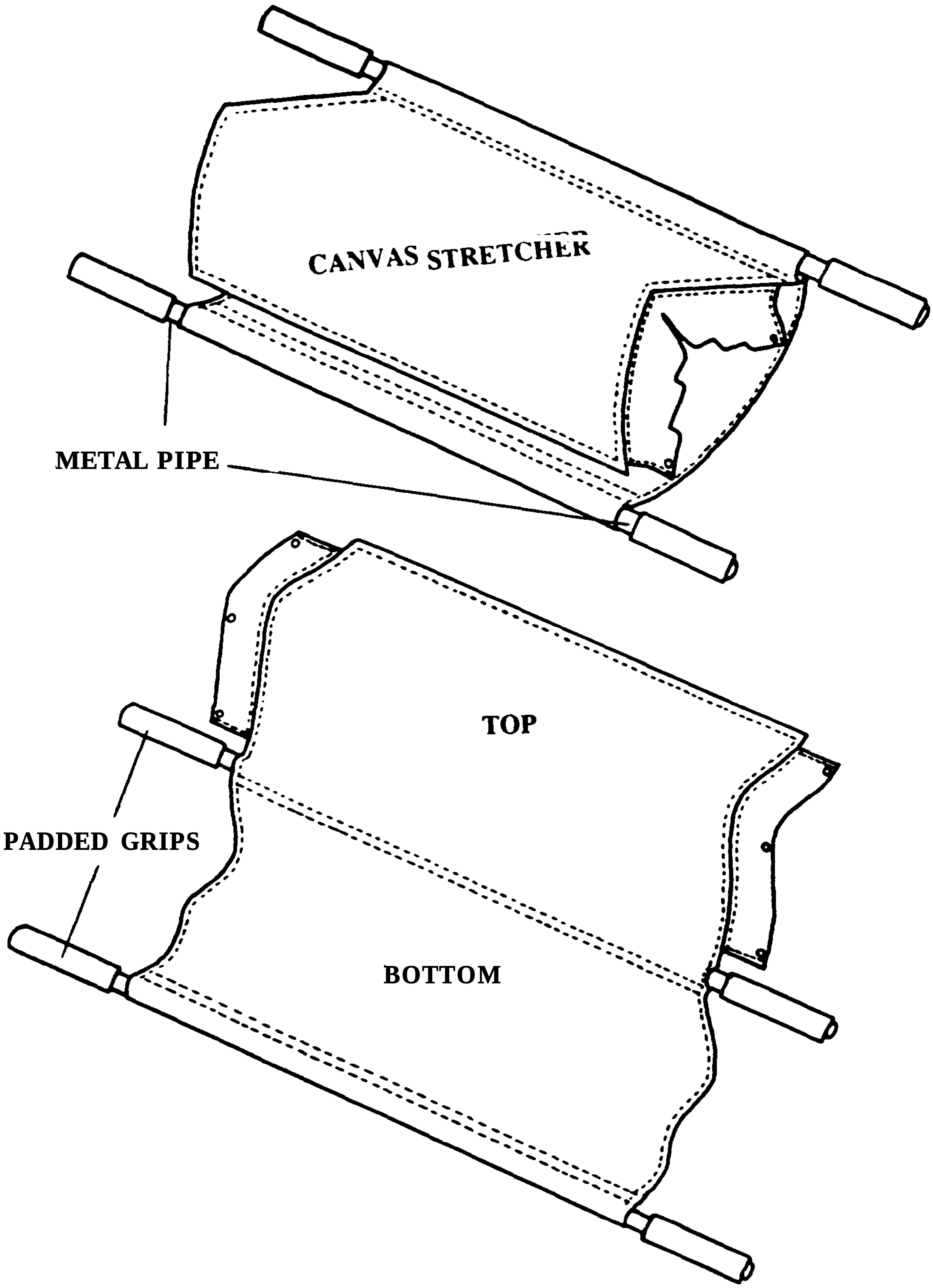


Fig. 3. Canvas stretcher used to carry Hancock live traps containing otters captured in the Cleanvater River within the Nez Perce Indian Reservation, Idaho, 1991-1992.

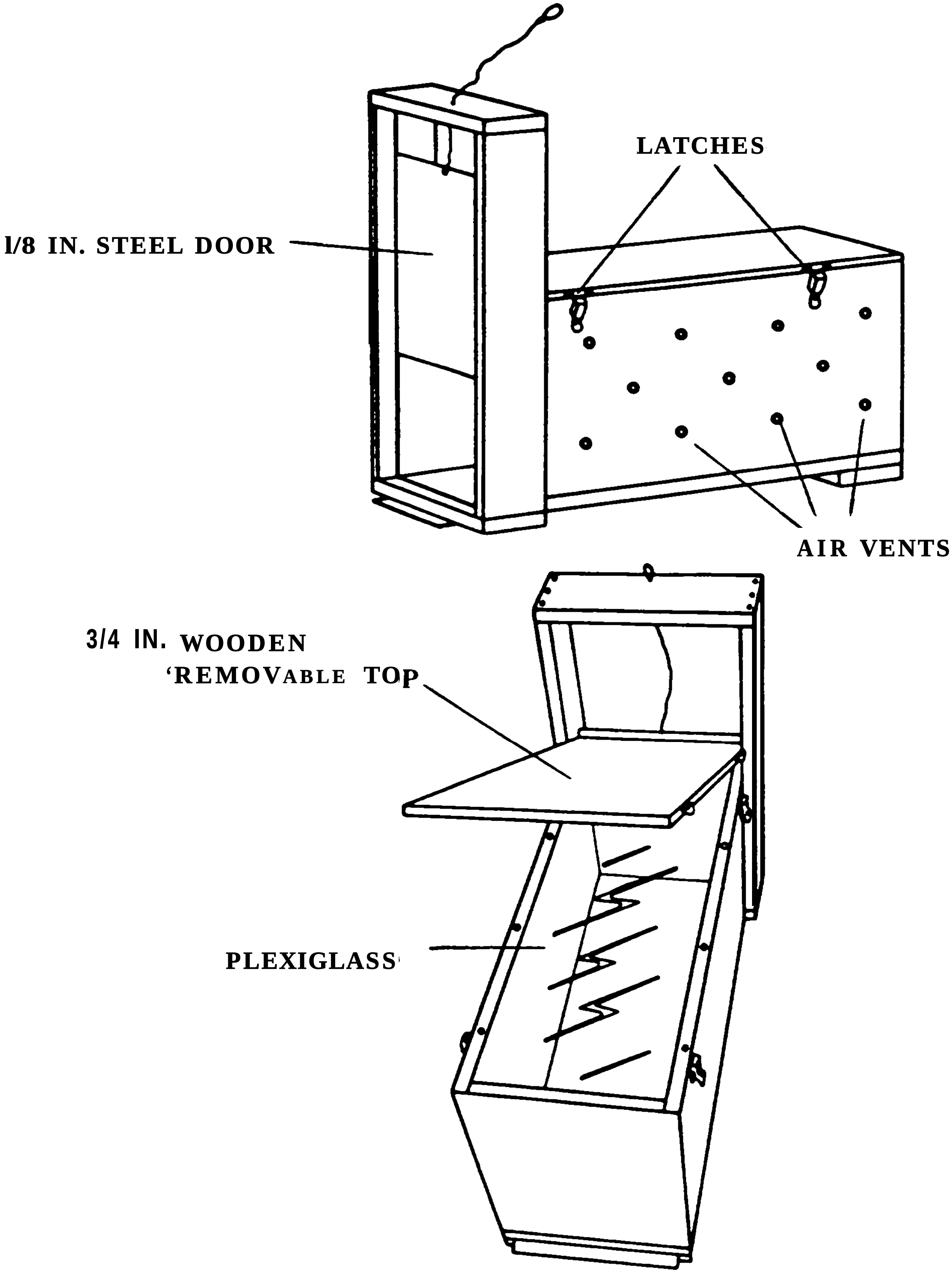


Fig. 4. River otter handling container used as a den box, transportation cage, and anesthesia chamber for captured river otters in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-1992.

chamber was opened and the otter was intubated with a number 16, 18, or 20 Cole® endotracheal tube, depending on otter size. Although laryngospasm occurred in several otters, it was not necessary to administer Cetocaine®. The otter was then connected to a closed circuit Halothane anesthetic machine and maintained at 300-500 cc per minute flow and 0.5-1.0% concentration, again depending on the size and individual needs of the otter.

Once intubated, the animal was prepared for surgery by clipping the fur on the left flank with a number 15 Oster blade followed by a surgical clipping with a number 40 Oster blade. Clipping the fur twice was necessary because otter fur is very dense. The surgical site was then washed with chlorhexidine surgical scrub followed by an application of 99% isopropyl alcohol. Surgical drapes were then placed and an incision approximately 5-7 cm in length and 5-7 cm caudal to the last rib was made through the skin and underlying fascia. Abdominal muscles were separated via grid incision, the peritoneum was perforated and the radio transmitter was implanted in the ventral abdomen. Closure was accomplished using either Vicryl® or PDS® suture material. One suture line of simple continuous stitches was used to close the peritoneum, and a second subdermal continuous suture line, three pointed to the gridded outer abdominal muscles to occlude any gaps in the tissue, was used to complete closure. This was not a subcuticular pattern but rather an edge to edge dermal anastomosis. The end result was an incision with no exposed suture material. All suture material used was adsorbable and PDS® was preferred because it does not wick and is not braided. After closure, DMSO" was applied to the incision line and allowed to dry. Nexaband® or Vet Bond' glue was then used to waterproof and seal the incision.

Following surgery and while the animal was still anesthetized, otters were weighed and standard morphological measurements were recorded. In addition, blood samples were collected with a 20 or 22 gauge needle from the coccygeal (tail) vein, and either an upper or lower incisor was removed for aging. Tooth samples were sent to Matson's Lab (Matson's Lab, Milltown, Montana 59851) for tooth cementum analysis. Otters were then returned to their ventilated and cleaned den boxes and the endotracheal tube removed at the first sign of recovery. Otters were returned to holding pens and released at or near their capture site 24-72 hours after surgery. The incision site was inspected through the plexiglass top of the handling box prior to release. Otters were transported to the release site in their handling box.

<u>Morphometric Measurements</u> - Morphometric measurements recorded for each otter included: total length, tail length, head length, hind foot length, tail circumference, neck circumference, chest circumference, head width, hind foot width, and uro-anal distance.

Blood Samples - Baseline normal values of blood parameters have not been established for river otters. We collected blood samples to augment existing data and contribute to the development of baseline blood chemistry parameters for otters. Blood samples of 7 captured river otters were prepared and sent to Pathologists' Regional Laboratory, P.A. of Lewiston, Idaho for standard biochemical and hematologic testing. Differences between the blood workups requested by the two assisting veterinarians resulted in a wider range of blood tests run on one group of blood samples versus the other. All samples were tested for biochemical values, and 4 samples were additionally tested for hematological values.

Combined Veterinary Panels, consisting of a complete blood count (CBC) and a multiple chemistry panel, were analyzed on Coulter Stak R and a Hitachi 717 analyzers, respectively. Storage and handling recommendations followed those of the College of American Pathologists (CAP), Shewhart/Westguard rules of rejection were observed, and CLIA 88 guidelines for reportable range was used.

RESULTS AND DISCUSSION

Trapping and Handling

Results of trapping efforts were based on 402 trap nights including 51 during spring and 331 during fall trapping seasons (Table 1). No captures resulted from 15 wet sets used during the first spring trapping season. Wet sets could not be maintained because of fluctuating water levels, and the lack of suitable trap sites hindered the use of this type of set. Because wet sets were ineffective in capturing otters they were not used during the other two trapping periods. Wet sets were excluded from the analysis reported here. More trail sets (274) were used than latrine sets (1081, and otter lure was used on only a few (74) of the trap sets.

Trapping efforts resulted in 13 river otter captures during the 3 trapping periods; 4 during the 2 spring trapping periods and 9 during the fall trapping season (Table 2). About the same number of otters were captured in the lower (n=7) and upper (n=5) Clearwater River sections. Nine males and 4 females were captured during the course of the study. Captured male otters included 3 juveniles, 1 yearling, and 5 adults. Captured females included 1 juvenile, 2 yearlings, and 1 adult. Males tended to be captured at a higher rate than females. Males were captured at equal rates during spring and fall trapping seasons. In addition, equal numbers of males were captured in trail and latrine site sets, and most males were captured in unlured rather than lured sets. Females were caught only during fall trapping season because we avoided trapping females during the spring breeding season. All females were captured in unlured latrine site sets.

Table 1. Trapping effort and number of otters captured in traps set at otter latrines (LT) and trails (TR) in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-1992 (results are presented for dry sets only).

	Trap Nights					Captures				
	Lured		Unlured		Total	Lured		Unlured		Total
Season	LT	TR	LT	TR	Sets	LT	TR	LT	TR	Captures
Spring	9	11	5	26	51	i	0	2	1	4
Fail	13	41	81	196	331	0	1	6	2	9
Total	22	52	86	222	382	1	1	8	3	13

Trap success was higher when using latrine sets (12.0 trapnights/capture.) than when using trail sets (68.5 trapnights/capture). Trapping results suggested no advantages of using otter lure when trapping river otters. Trap success was about equal when using lure (37.0 trapnights/capture) and unlured (28.0 trapnights/capture) sets.

Trap success was 31.0 trapnights/capture over all trap types and seasons. Trap success, excluding wet sets, was 29.0 trapnights/capture. Excluding wet sets, trap success during spring trapping seasons was 12.8 trapnights/capture, while success during the fall trapping season was 36.8 trapnights/capture. Success rates were greatest for unlured latrine sets (10.8 trapnights/capture) and lowest for unlured trail sets (74.0 trapnights/capture).

Hancock live traps require specific site characteristics, including organic substrates, to be effective. Even though few suitable sites were available in the Clearwater River due to the abundance of rocky shorelines, trapping efforts in the study area were very successful. Spring can be an effective trapping season because of increased movements of males looking for breeding females. Trap success was almost three times higher in spring than during the fall season. However, trapping females during the spring breeding season is not recommended, and the additional effort required in avoiding trapping breeding females and having to check traps more frequently limits the number of suitable trap sites and size of trap lines that can be maintained. High trap success rates are attributed to the concerted effort at the beginning of the study to identify the best sites to concentrate trapping efforts.

Table 2. Sex, age and chronological summary of trapping dates, surgery dates, release dates, and status for instrumented river otters in the Cleatwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Animal ID	Sex	Aae Class(yr)		Dates Captured	Implanted	Released	Status	
Ml	Male	Adult	(5)	04/04/91	04/06/91	04/09/91	Lost contact[b]	02/18/92
M2	Male	Adult	(-)[a]	05/09/91	05/09/91	05/11/91	Transmitting'	12/31/92
M3	Male	Yearling	(1)	09/27/91	10/01/91	10/03/91	Transmitting	12/31/92
M4	Male	Juvenile	(0)	10/19/91	10/21/91	10/23/91	Transmitting	12/31/92
M5	Male	Juvenile	(0)	10/19/91			Mortality*	10/21/91
M6	Male	Adult	(-)	10/24/91	10/27/91	10/29/91	Transmitting	12/31/92
F7	Female	Yearling	(1)	11/08/91	11/10/91	11/11/91	Mortality'	11/18/91
F8	Female	Yearling	(1)	11/14/91	11/19/91	11/21/91	Mortalityf	06/25/94
F9	Female	Adult	(3)	11/21/91	11/21/91	11/23/91	Mortality[g]	06/21/94
FlO	Female	Juvenile	(0)	11/21/91	11/21/91	11/23/91	Mortality[h]	04/14/92
Ml1	Male	Adult	(2)	03/25/92	03/25/92	03/27/92	Transmitting	12/31/92
Ml2	Male	Adult	(7)	04/02/92	04/02/92	04/03/92	Transmitting	12/31/92

[a] No tooth sample taken to verify age.
[b] Status unknown, Lost radio signal.
[c] Currently transmitting.
[d] Study related mortality, anesthesia overdose during to surgery.
[e] Cause of mortality unknown, carcass showed extensive hemoraging across shoulders and back.
[f] Killed by motor vehicle while crossing road.
[g] Cause of mortality unknown, recovered transmitter only, carcass could not be retrieved.
[h] Cause of mortality unknown, recovered transmitter only, carcass could not be retrieved.

Surgery

Twelve otters underwent surgery. One otter was lost during administration of isoflorane anesthetic; and we recommend that this drug not by used on river otters. Halothane was successfully used elsewhere (Mack 1985) and performed well in this study. Using Halothane as the anesthetic, induction was predictable and short (mean = 7 minutes), a surgical plane of anesthesia was easily maintained, and otters experience a smooth recovery. The actual surgery time, from the first incision to closure, averaged 15 minutes. Overall processing time, including induction, pre-surgery preparation, surgery, and post-surgery processing, averaged 51 minutes.

Morphometric Measurements - Sample sizes were too small for statistical comparisons of morphometric measurements between sexes or ages of Clearwater otters. Mean morphometric measurements for captured male and female otters are presented in Appendix A. For males, measurements were variable between age categories. Most measurements increased with age, with little overlap between juvenile and yearling age classes. However, measurements of adult otters overlapped considerably with the other two age classes. Hind foot length, neck circumference, and chest circumference had considerable overlap in measurements between all male age classes.

The only other study we found that reported morphometric measurements and weights of otters in Idaho was that of Melquist and Hornocker (1983) who studied the population ecology of otters in the upper Payette River drainage. Morphometric measurements of otters captured in the Clearwater River were compared to those reported for captured otters in the Payette River in central Idaho. Low sample sizes precluded comparisons between all sex and age classes. Comparisons were made between all male age classes and yearling females for total length, tail length, and hind foot length. Total lengths of juvenile males ($t = 11.59$, 15 df, $P < 0.051$, and yearling males ($t = 3.1$, 7 df, $P < 0.05$) and yearling females ($t = 3.9$, 3 df, $P < 0.05$) were significantly larger for Clearwater otters. Except for hind foot lengths of yearling male and female otters, mean standard measurements for tail length and hind foot length were larger for Clearwater otters, but not significantly. Hind foot lengths reported for yearling male and female otters in the Payette drainage were larger than those reported for the Clearwater otters. Yearling male Payette otters had significantly larger hind feet, but, measurements for Clearwater river otters came from only two animals.

For combined sexes, mean weights of Clearwater juvenile, yearling, and adult river otters were 7.0, 9.6, and 11.8 kg respectively (Table 3). Mean weights of combined sexes of Clear-water River river otters, were significantly heavier than those reported by Melquist and Hornocker for juveniles (mean = 7.0 kg Clearwater, mean = 4.4 kg Payette) ($t = 15.66$, 35 df, $P < 0.05$), yearlings (mean = 9.6 kg Clearwater, mean = 7.6 kg Payette) ($t = 8.58$, 11 df, $P < 0.05$), and adults (mean = 11.8 kg Clearwater, mean = 8.6 kg Payette) ($t = 5.2$, 13 df, $P < 0.05$).

Table 3. Mean weights (kg) of river otters captured in the Cleamater River within the Nez Perce Indian Resenration, Idaho, 1991-92.

Sex/Age class	n	x	SD	min.	max.
Males					
Juvenile	2	6.6	0.9	6.0	7.2
Yearling	2	9.1	0.1	9.0	9.1
Adult	4	12.2	2.2	10.0	14.2
Females					
Juvenile	1	7.8			
Yearling	2	10.2	0.1	10.1	10.2
Adult	1	10.3			
Combined Sexes					
Juvenile	3	7.0	0.9	6.0	7.8
Yearling	4	9.6	0.6	9.0	10.2
Adult	5	11.8	2.1	10.0	14.2

Small sample sizes precluded comparisons of weights between all ages and sex classes. Comparisons were made between adult and juvenile males and yearling females. Clearwater juvenile male otters were significantly heavier than Payette juvenile male otters ($t = 2.09$, 11 df, $P < 0.10$). Although adult male Clearwater otters had greater mean weights, these could not be shown to be statistically significant due to small sample sizes and large variances in both Clearwater and Payette samples. Yearling female Clearwater otters were significantly heavier than those on the Payette ($t = 16$, 3 df, $P < 0.05$).

Although small sample sizes precluded statistical comparison of all age and sex categories, the data suggest that river otters in the Clearwater River are larger and weigh more than otters in the Payette River. We suspect that the comparatively higher productivity, in terms of densities of easily obtainable prey items such as forage fish and crayfish, of the lower Clearwater River drainage may contribute to faster growth rates of otters.

<u>Blood Samples</u> - Values for blood chemistry parameters varied widely. Sample sizes were too small to consider results unbiased estimates of the natural variability in the population of otters in the Clearwater. In addition, to what extent results may have been influenced by capturing, handling, and implanting otters is not known. However, stress and anesthetics used during surgery can potentially influence certain blood parameters. Serum biochemical values for river otters captured in the Clearwater River are presented in Table 4. Calcium levels were lower and phosphorous levels higher than expected for other similar animals. Eoth alanine transaminase and aspartate transaminase enzymes were higher than anticipated. Hematological values are presented in Table 5. Results were within values considered normal for similar animals.

Table 4. Serum biochemical values for river otters captured in the Clearwater River within the Net Perce Indian Reservation, Idaho, 1991-92.

Biochemical factors	n	x	SD	min.	max.
Total protein (g/dl)	7	7.0	c.5	6.1	7.6
Albumin (g/dl)	7	3.3	0.2	3.2	3.6
Calcium (mg/dl)	7	8.2	0.6	7.1	9.2
Inorganic P (mg/dl)[a]	6	11.8	5.2	5.3	19.5
Cholesterol (mg/dl)	7	190.0	47.8	119.0	257.0
Uric acid (mg/dl)	7	1.9	3.5	1.4	2.8
Creatinine (mg/dl)	4	0.6	0.1	0.5	0.8
Total bilirubin (mg/dl)	7	0.3	0.2	0.1	0.7
ALT (IU/L)[b]	4	219.0	194.7	83.0	508.0
SAP (IU/L)[c]	7	87.7	40.3	45.0	161.0
AST (IU/L)[d]	6	287.3	195.6	82.0	634.0
Sodium (mEq/L)	4	155.0	3.6	152.0	160.0
Potassium (mEq/L)	4	4.8	1.1	4.2	6.4
Chloride (mEq/L)	4	115.0	5.4	109.0	122.0
Glucose (mg/dl)	7	161.4	47.9	89.0	216.0
BUN (mg/dl)[e]	7	38.1	5.9	30.0	46.0

[a] P - Phosphorus
[b] ALT - Alanine transaminase
[c] SAP - Serum alkaline phosphatase
[d] AST - Aspartate transaminase
[e] BUN - Blood urea nitrogen

The only blood chemistry values collected for river otters, that we were aware of, was reported by Hoover (1984) and our results were in general agreement. Noted differences between our results and those reported by Hoover included: Leukocyte differential showed higher segmented neutrophil counts but lower eosinophil and basophil counts, and unexplained increased inorganic phosphorus, ALT, and AST levels. The cause of the elevated levels over those reported by Hoover is unknown, but low sample sizes for both studies made interpretation difficult. Additional sampling is required to accurately describe blood chemistry parameters for river otters.

Table 5. Hematologic values for river otters captured in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Hematologic factors	n	x	SD	min.	max.
Plasma total protein (g/dl)	7	7.3	0.5	6.1	7.6
WBC count (k/mm^3)	4	14.2	4.1	10.2	18.3
RBC count (m/mm^3)	4	8.1	0.5	7.7	8.7
Hemoglobin (g/dl)	4	14.6	1.2	13.3	15.9
PCV (%)[a]	4	41.1	2.8	38.0	44.1
MCV (fl)[b]	4	49.7	1.7	46.7	50.9
MCH (pg)[c]	4	18.0	0.6	18.4	18.0
MCHC (g/dl)[d]	4	35.4	0.6	34.8	36.1
Leukocyte differential					
SEG neutrophils (k/mm^3)[e]	4	12.3	4.6	3.0	16.5
Band neutrophils (k/mm^3)	4	0.2	0.2	3.0	0.4
Lymphocyte (k/mm^3)	4	1.7	1.0	0.3	3.1
Monocytes (k/mm^3)	4	0.2	0.3	0.0	0.7
Eosinophil (k/mm^3)	4	0.1	0.1		0.2
Basophils (k/mm^3)	4	0.0	0.0	0.0	0.0

[a] PCV - Packed red cell volume
[b] MCV - Mean corpuscular volume
[c] MCH - Mean corpuscular hemoglobin
[d] MCHC - Mean corpuscular hemoglobin concentration
[e] SEG - Segmented

DISTRIBUTION OF RIVER OTTERS IN THE CLEARWATER RIVER

INTRODUCTION

The initial objective of this project was to determine the general distribution of river otters in the Clearwater River drainage and, more specifically, within the study area. Collecting distribution data was important to determine boundaries and spatial relationships of otter populations and to correlate distribution of otters with gross habitat types within different reaches of the drainage. Additionally, distribution data collected within the study area was used for a preliminary assessment of otter habitat use, in fine tuning project study design, and in identifying potential sites for future trapping efforts.

METHODS

Distribution of river otters was assessed using three different methods. A mail survey was distributed to initially assimilate the collective, common knowledge of otter habitats and populations in the drainage. In addition, an intensive survey for otter sign along the entire length of the mainstem Clearwater River and the lower 5 km of tributary streams, within the study area, was conducted to acquire more specific information on distribution of otters in the study area. Finally, river otter latrine site surveys were conducted throughout the duration of the project to monitor seasonal changes in otter distribution in the study area.

Mail Survey

The mail survey was designed to target individuals who had considerable knowledge of both river otters and otter habitats in the Clearwater drainage. Copies of the questionnaires were mailed to the Idaho Department of Fish and Game. Clearwater Region Office; and the Nez Perce and Clearwater National Forest Supervisors Offices for distribution to fish and wildlife biologists. Questionnaires were also mailed to local members of the Idaho Trappers Association. The questionnaire was composed of two parts: general information and specific observations. The general information section questioned participants about their general knowledge of habitat conditions, habitat use, and population status and trend of river otters within sections of the Clearwater drainage familiar to the participant. The specific observations section asked participants to report all locations where they had observed river otters or their sign.

Results of the general section were summarized by frequency of responses to each question. All locations of reported otter sightings were plotted on a map to provide a visual display of the general distribution of otters in the drainage.

Sign Survey

The entire length of the mainstem Clearwater River within the study area was surveyed for otter sign during the first field season (March - October 1991). A jetboat was used to survey all potential otter habitats along the shore for otter tracks, scent stations, scats, rubbing/rolling sites, and latrine sites. The potential quality of otter habitat at each surveyed site was assessed according to the amount and types of otter sign found, and the physical habitat characteristics of the site. In addition, each site was evaluated for potential trapping opportunities.

Location, type (bank, stick, stick/bank) and status (active, inactive, undetermined) of all located beaver dens were also documented because of their potential use by otters for denning sites. Additional beaver colony surveys were conducted in the fall of 1991 and 1992 to monitor numbers and status of beaver colonies in the study area.

In addition, the lower 5 km of tributary streams in the study area were searched for otter sign during the summer of 1992. Tributaries were grouped according to drainage size and discharge as either "large" or "small". Large tributaries were perennial streams having minimum flows greater than 0.10 m^3/sec (Murphy 1986). These tributaries drained timbered headwater reaches, before coursing through agricultural lands. Large tributaries sampled included Clear Creek, South Fork Clearwater River, Lo10 Creek, Orofino Creek, and Potlatch River. Drainages of small tributaries where solely contained within agricultural lands. These streams ran through dry, open canyons that were heavily logged and grazed. Many of these streams became intermittent during the late summer months and all had minimum flows less than 0.10 m^3/sec (Murphy 1986). Small tributaries surveyed in the study area included Big and Little Canyon Creeks, Jacks Creek, Cottonwood Creek, and Lapwai Creek.

Latrine Site Survey

A subset of the documented latrine sites were surveyed on a monthly basis from January to December, 1992. Because the study design called for surveys to be completed in as short a time span as possible (preferably one day) and for sites to be monitored throughout the year, only latrine sites readily accessible year-round by vehicle were sampled. The number of latrine sites sampled during any one survey varied because additional latrine sites were surveyed as new sites were documented through ongoing concurrent radio monitoring efforts of instrumented otters.

For each latrine site sampled, status was recorded as either active (scats or other otter sign present) or inactive (no scats or otter sign present). At active sites, the number of scats was recorded and all scats were collected for analysis of diet composition. After the data were collected, all otter sign was obliterated. Two measures, activity status and an activity index, were estimated to assess seasonal changes in latrine site use, and to compare latrine site use between lower and upper Clearwater River sections.

Activity status was used to monitor change in the number of active latrine sites between seasons and river sections, and the activity index measured the amount of activity associated with active latrine sites. An activity index was calculated for each active latrine site by dividing the number of collected scats by the number of days since the last survey. Pearson Chi-square tests were used to detect seasonal patterns in the number of active latrine sites for both the lower and the upper Clearwater River sections. Two-tailed Fisher Exact tests were used to compare differences in seasonal status of latrine sites between the two sections. ANOVA was used to compare mean seasonal activity indices within and between river sections.

RESULTS

Mail Survey

Sixty-seven Questionnaires (Appendix B.l) were sent to local experts on river otters and river otter habitat. We received 26 responses from the Idaho Department of Fish & Game, Idaho Trappers Association, Clearwater National Forest, Nez Perce National Forest, and other agencies. Of the respondents, 14 offered general information on river otter habitats and populations, and participants supplied 70 sightings of river otters or their sign.

<u>General Information: Otter habitats and populations</u> - Questionnaire respondents indicated river otters generally occurred throughout the Clearwater River drainage including all three rivers (Clearwater, Selway, and Lochsa) and many of the larger tributaries. We received 40 reports regarding general information on river otter habitats and populations for 18 different tributary streams and river sections of the Clearwater River drainage (Appendix B.2). Respondents reported river otter habitat existed along all 3 of the main rivers within the Clearwater drainage and the Snake River. In addition, we received information regarding 13 different tributary streams of the Clearwater River drainage including the Potlatch River and its tributaries (East Fork Potlatch and Elk Creek), Bedrock Creek, North Fork Clearwater River and its tributaries (Kelly Creek), Orofino Creek, Lolo

Creek and tributaries (Eldorado Creek), and the South Fork Clearwater River and its tributaries (South Fork Red River, North Fork Red River, and Red River). Reports were evenly divided between main rivers (n=21) and tributary streams (n=19).

River Otter Habitat. Although there was little agreement on habitat conditions for certain areas of the drainage for which we received multiple reports, the majority of the respondents considered habitat conditions to be either good or fair for all reaches. Given choices of good, fair, or poor, 75% of all respondents reported otter habitats to be in good condition. Most (90%) of the respondents considered otter habitats along rivers to be in good condition, while habitats along tributary streams were reported, in approximately equal proportions, to be in either good or fair condition.

River Otter Populations. Questionnaire participants acquired knowledge of river otter population status through reports of otter observations received from the public and through first hand observations of otters and their sign. Given choices of frequent, infrequent but consistent, or infrequent and sporadic, the majority (90%) of respondents reported receiving reports from the general public of otters either frequently or infrequently but consistent.

The results of this section of the questionnaire suggested that otters were common with resident, stable or increasing populations found predominantly in main rivers rather than tributary streams in the drainage. More than half of the respondents (68%) reported otters being common, rather than abundant or uncommon, in the reaches for which they had knowledge. Otters were reported to be uncommon in portions of the Potlatch River, upper Clearwater River, lower Clearwater River, and South Fork Clearwater River (above Golden and South Fork Red River) reaches. Otters were reported to be abundant in the upper Clearwater River section (Lo10 Creek, Eldorado Creek), Lochsa, lower Clearwater River section, and Middle Fork Clearwater River reaches. Most (67%) respondents reported river otters to be resident populations. All considered otter populations to either be stable or increasing rather than decreasing. Finally, 68% of the respondents reported otters using mostly habitats along the main rivers rather than tributary streams in the drainage.

<u>Specific Observations: River otter Sightinas</u> - Most of the observations of river otters (80%) were from first hand information of either direct observation of live, free ranging otters or from trapped animals. Although otters were observed during all seasons of the year, more observations were reported during the fall (27%) and winter (46%) than spring (15%) or summer (12%). Generally, we received an equal number of otter sightings from main rivers and tributary streams within the drainage (Fig. 5).

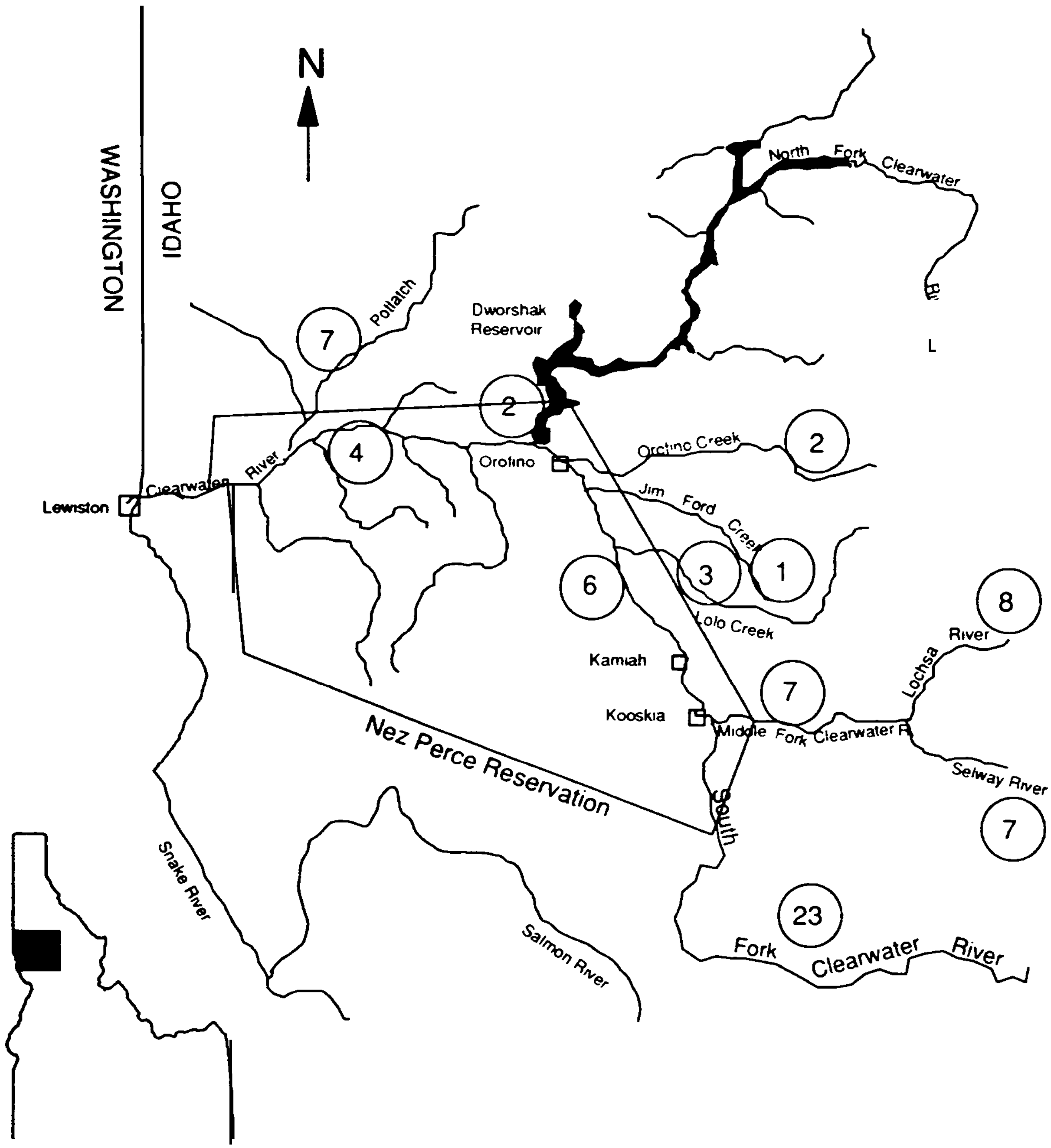


Fig. 5. Number and location of reported river otter sightings in the Clearwater drainage, Idaho 1991.

Of the 70 reported sightings, 31 (44%) were observed in main rivers (Table 6). Participants reported 17 sightings of otters in Clearwater River reaches, 7 in the Lochsa River, and 7 in the Selway River. Thirty nine (568) of the sightings were recorded in tributary streams of the Clearwater drainage. Of these, 23 (58%) were from the South Fork Clearwater River and its tributaries (Red River, North Fork Red River, Moose Butte Creek, Silver Creek, and Trapper Creek), 7 (18%) were from the Potlatch River and its tributaries (East Fork Potlatch, Ruby Creek, Elk Creek Reservoir, Spring Valley Reservoir, and Moose Creek Reservoir), and 6 (16%) from upper Clearwater River tributary streams (Fords Creek, Lolo Creek, and Orofino Creek). In addition, we received reports of 2 sightings in the North Fork Clearwater River, and 1 sighting from Deadman Creek, a tributary of the Lochsa River.

Table 6. Number and location of river otter sightings reported by participants of the Cleamater River Otter Projects' river otter distribution mail survey, Idaho, 1991.

Reach	No. of Sightings
Mainstem	
Lower Clearwater River	4
Upper Clearwater River	6
Middle Fork Clearwater River	7
Lochsa River	7
Selway River	7
Subtotal	31
Tributaries	
North Fork Clearwater River	2
Upper Clear-water River Section	
Jim Ford Creek	1
Lo1o Creek	3
Orofino Creek	2
South Fork Clearwater River	14
Trapper Creek	1
Red River	2
North Fork Red River	2
Moose Butte Creek	2
Silver Creek	2
Lochsa River	
Deadman Creek	1
Potlatch River	1
Moose Creek Reservoir	2
Spring Valley Reservoir	1
East Fork Potlatch River	1
Ruby Creek	1
Elk Creek Reservoir	1
Subtotal	39
Total	70

Sign Survey

During initial sign survey efforts in 1991, 160 miles of Clearwater River shoreline were searched. Otter sign was observed frequently throughout the study area and 40 potential otter latrine sites were documented (Appendix C). An additional 10 latrine sites were documented during subsequent monitoring efforts of instrumented otters (Fig. 6). Of the total 50 sites, 29 were located in the lower Clearwater River section (LCR) (0.73 latrines/mile), while 21 were located in the upper Clearwater River section (UCR) (0.53 latrines/mile).

Sign surveys conducted on tributaries in the study area suggested that some larger tributaries received frequent use by otters and most small tributaries receive infrequent or no use. Frequent otter sign was observed in Lo1o Creek and the Potlatch River. Infrequent sign was observed in Clear Creek and Orofino Creek. Lapwai Creek was the only small tributary in which otter sign was observed.

During the initial sign survey, 39 beaver dens were documented (Appendix D) . Twenty four active colonies were documented, 9 dens were determined to be inactive, and activity status could not be determined for the remaining 6 dens. Although the number of dens were evenly distributed between the lower (n=19) and the upper (n=20) Clearwater River, the majority of active colonies were located along the lower Clearwater River (LCR) (n=15 LCR, 0.38 colonies/mile; n=9 UCR, 0.23 colonies/mile), and more inactive dens were located along the upper Clearwater River (UCR) (n=2 LCR, n=7 UCR).

Twenty additional beaver dens were documented during the 1992 fall survey (Fig. 7). Just over half (n=13) of the newly documented dens were located along the LCR. The total of 59 dens were evenly distributed with 32 located along the LCR and 27 along the UCR. Distribution of both active and inactive beaver dens was more even between the LCR and UCR in 1992. Of the 43 active colonies, 23 (0.56 colonies/mile) were located along the LCR, while 20 (0.50 colonies/mile) were located along the UCR. Of 8 inactive dens, 5 were located along the LCR, while 3 were located along the UCR.

The status of beaver dens documented in 1991 was tracked through 1992. Of the 39 dens documented in 1991, 2 beaver lodges were no longer present (probably washed away during spring high water and subsequently not rebuilt during the summer), 3 could not be relocated, and the status of 8 could not be determined. Of the 26 beaver lodges for which activity status could be tracked from

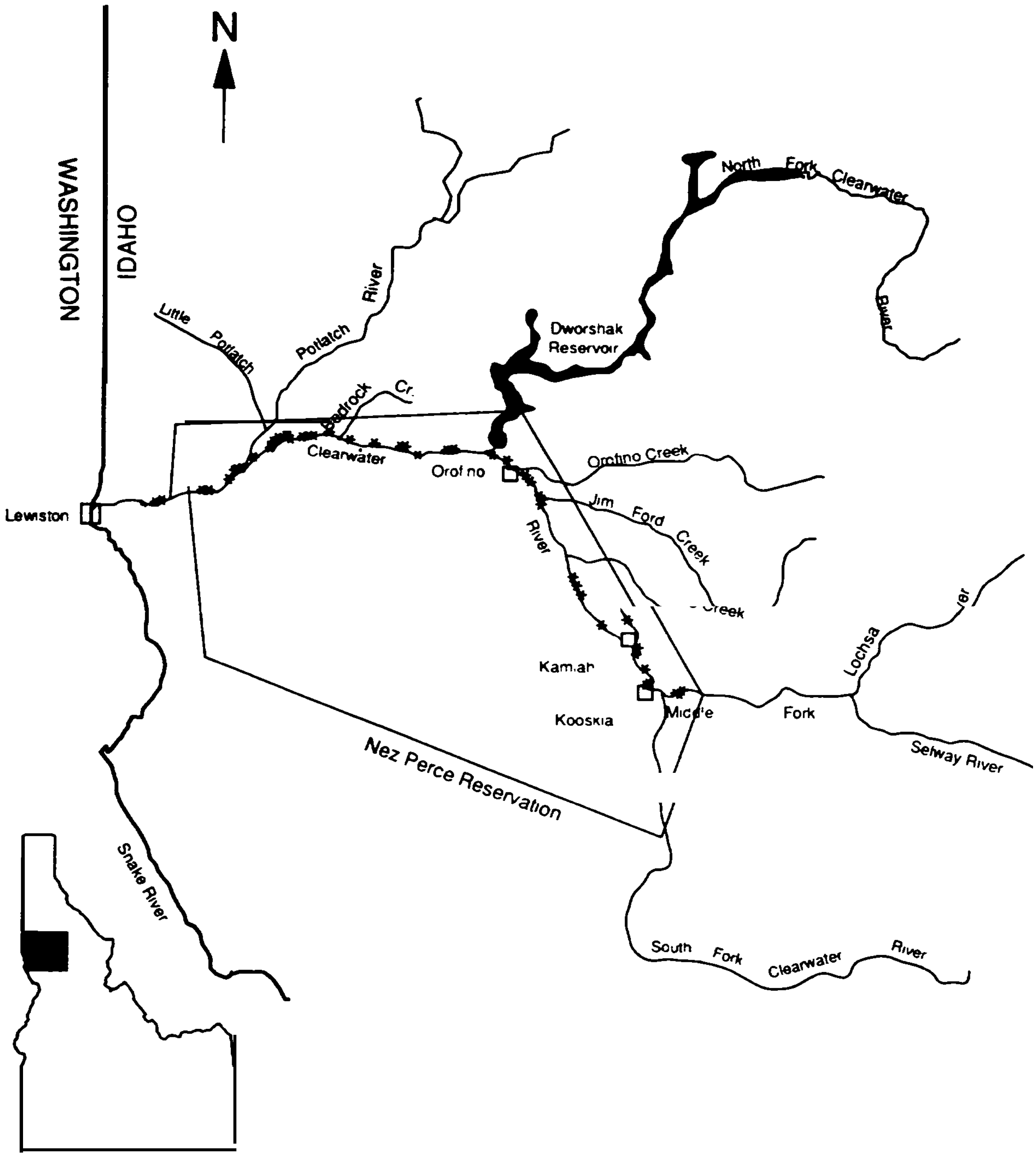


Fig. 6. Distribution of river otter latrine sites documented in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

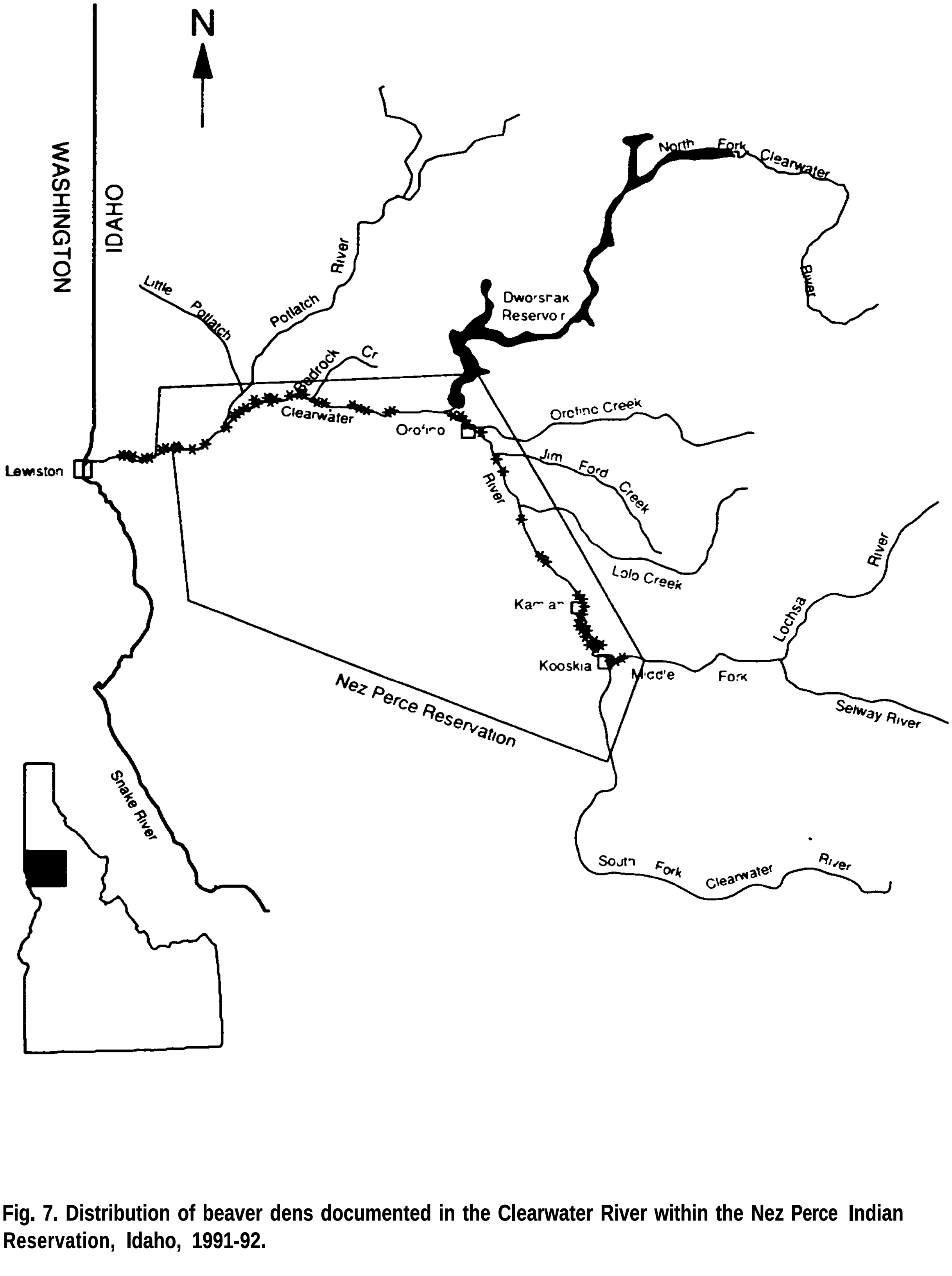


Fig. 7. Distribution of beaver dens documented in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

1991 to 1992, slightly over half (n=9 LCR, n=9 UCR) did not change in status, and an equal number of lodges changed from active to inactive (n=l LCR, n=3 UCR) and inactive to active (n = 4 LCR).

During 1991 and 1992 surveys the majority of documented beaver dens were active with the proportion of active colonies only slightly higher in 1992 (84%) than in 1991 (73%).

Latrine Site Survey

A subset of twenty latrine sites were sampled on a monthly basis: 12 in the lower and 8 in the upper Clear-water River sections. A total of 208 samples were obtained, 128 (62%) from lower and 80 (39%) from upper Clearwater River sites.

Activitv Status - On an annual basis over the entire river, 80% of all latrine sites were active (Table 7). More latrines surveyed in the LCR were active (88%) than surveyed in the UCR (66%)(Chi-square = 13.434, 1 df, $P < 0.001$).

The percentage of active latrine sites remained high throughout all seasons (Table 7). For the entire Clear-water River, sampled latrines were active 80%, 78%, 84%, and 80% of the time during spring, summer, fall, and winter surveys, respectively. No significant changes in the seasonal status were detected for the entire river (Chi-square = 0.543, 3 df, $P = 0.909$), or for either the lower (Chi-square = 0.781, 3 df, $P = 0.854$) or upper (Chi-square = 2.869, 3 df, $P = 0.412$) Clearwater River sections. The percentage of active latrines recorded for the LCR was greater in all seasons compared to those sampled in the UCR, although these differences were not significant.

Activitv Index - Activity indices were consistently higher for LCR latrine sites for all seasons (Table 8). However, the variation in activity for each individual latrine site was too great to detect any significant differences between upper and lower river sections ($F = 1.90$, $P = O-1848$), seasons ($F = 1.00$, $P = 0.1794$), or seasons within sections ($F = 1.17$, $P = 0.3327$).

Table 7. Seasonal activity status for documented river otter latrine sites in the Cleawater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Section/Season	Status			
	Active		Inactive	
	n	(%)	n	(%)
Lower[a]				
Spring	25	(86.2)	4	(13.8)
Summer	43	(91.5)	4	(8.5)
Fall	21	(87.5)	3	(12.5)
Winter	24	(85.7)	4	(14.3)
Annual	113	(88.3)	15	(11.7)
Upper[b]				
Spring	15	(71.4)	6	(28.6)
Summer	15	(55.6)	12	(44.4)
Fall	11	(78.6)	3	(21.4)
Winter	13	(72.2)	5	(27.8)
Annual	54	(67.5)	26	(32.5)

[a] Lower - Mainstem Clearwater River from its mouth at Lewiston upstream to ifs confluence with the North Fork Clearwater River at Orofino.

[b] Upper - Mainstem Clearwater River from it's confluence with the North Fork Clearwater River at Orofino upstream to the eastern reservation boundary near Kooskia.

Table 8. Mean seasonal activity indices for documented river otter latrine sites in the Cleatwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Section/Season	n	Activity Index[a]			
		x	SD	min.	max.
Lower[b]					
Spring	25	C.284	0.175	C.000	0.700
Summer	43	C.382	0.340	C.030	1.660
Fall	21	0.486	3.422	C.000	1.420
Winter	24	0.436	0.949	C. OCO	4.760
Annual	113	0.407	0.546	0.000	4.760
Upper'					
Spring	15	0.226	0.249	C. 000	0.970
Summer	15	C.190	0.166	0.030	0.520
Fall	11	0.275	0.283	0.030	0.940
Winter	13	0.182	0.253	0.000	0.830
Annual	54	0.215	0.233	0.000	0.970

• Activity Index = number of scats collected / number of days since last survey.

[b] Lower - Mainstem Clearwater River from it's mouth at Lewiston upstream to it's confluence with the North Fork Clearwater River at Orofino.

[c] Upper - Mainstem Clear-water River from it's confluence with the North Fork Clearwater River at Orofino upstream to the eastern reservation boundary near Kooskia.

DISCUSSION

The information we gathered through the mail survey, otter sign surveys, latrine site surveys, and reports of otter sightings received from the public through the course of the study provided an accurate picture of the general distribution of river otters in the Clearwater drainage, and more specific insights into the distribution of otters within the study area.

Distribution Within the Clearwater Drainage

Although the number of questionnaires distributed was small, we targeted our audience to include either professional resource managers or trappers, all of whom had knowledge of river otters and river otter habitats in the drainage. The high response rate (39%) was encouraging and indicated that people who had knowledge did respond. In addition, most of the information reported stemmed from first hand sightings of either otters or otter sign in the field, which added credibility to the data collected.

The information we received regarding otter habitat conditions and population status indicated otters were generally found uniformly throughout the drainage. Although the information gathered was not detailed enough to allow comparisons of otter habitats or populations between different river and stream reaches, the majority of the drainage was considered to be good habitat for river otters, supporting stable or increasing populations of resident otters, and otters were considered common along most reaches of the drainage.

Similarly, the information we gathered regarding locations of otter sightings also indicated otters occurred throughout the drainage. Otters were observed in all of the main rivers (Clearwater, Lochsa, and Selway) and larger tributary streams, primarily the South Fork and Potlatch Rivers, within the drainage. Possible explanations why greater number of otters were sighted in the tributaries to the Clearwater River than tributaries to other rivers in the drainage include: 1) because these tributaries are in the lower end of the drainage and tend to have larger flows and be more productive than headwater tributaries, they have the potential to support higher densities of otters; and 2.) tributaries to the Clearwater River, flowing through more developed agricultural lands, were more accessible, increasing opportunities to observe otters.

Although information we gathered suggested population centers in the drainage occurred along the mainstem rivers, in the Red River drainage, and in the upper tributaries of Lolo Creek and the Potlatch River, we believe river otters can be found in any river or stream in the Clearwater River drainage having year-round flows sufficient for an otter to navigate, and supports a healthy fisheries to supply ample forage.

Distribution Within the Study Area

Results of latrine site and sign surveys indicated otters were found throughout the study area. The high percentage of repeated use of individual latrine sites by otters indicates latrine site surveys were a reliable indicator of otter distribution. Use of sampled latrine sites by otters remained high throughout all seasons for both the lower and upper river sections, and the relative differences in latrine use between river sections did not vary. This suggests otters were uniformly distributed and use all sections of the Clearwater River year-round. Sign surveys also suggested larger tributaries within the study area also received frequent use by otters.

Through observations of family groups and mating otters, by project personnel and the public, we estimated the study area supported a minimum of 8-12 breeding female otters. Information also suggested that the lower river section may support higher densities of breeding females than the upper river section: no adult females were captured in the upper river section, no mating otters were observed in the upper river section compared to 4 observations in the lower river section, and more family groups were observed in the lower (4) than the upper (2) river sections. We estimated that the lower river section supported a minimum of 6-13 breeding female otters. We did not obtain an estimate for the number of breeding females in the upper river section but suspected it may be less than the lower river section based on the low number of family groups observed. Through the course of the study, we received no reports from the public regarding observations of family groups in this section and only two family groups were observed by project personnel in the upper river section.

HOME RANGE AND MOVEMENTS OF RIVER OITERS IN THE CLEARWATER RIVER

INTRODUCTION

Movements of otters in the Clearwater River were investigated to acquire a sense of scale for designing effective mitigation. Movement data provided information on: 1) Minimum area estimates for population boundaries and what proportion of the otter population the study area encompassed, 2) how much (length of shoreline) habitat was required for individual otters in the Clearwater River and, and 3) whether those requirements were the same for male and females. Movement data also provided information regarding habitat use on a course scale by identifying use of different waterway categories (mainstem rivers, large tributaries streams, or small tributaries streams).

This information will help define the scope required to implement effective mitigation measures for otter habitats in the Clearwater River. Data regarding population boundaries will identify what proportion of the population will be affected by mitigation measures implemented in the study area. In addition, information on movements of otters will be used to prioritize the most important waterways for mitigation measures and identify measures addressing habitat requirements particular to specific segments of the population.

METHODS

Home range length and consecutive-day movements of river otters were evaluated using radio location data collected from instrumented animals. Home range length was estimated for each instrumented otter by measuring the length (km) of river and tributaries encompassed within the furthest downstream and upstream locations. Mean consecutive-day movements were estimated for each instrumented otter by averaging straightline distances moved between all consecutive daily locations.

Sample sizes were too small to make inferences to the general population of otters. We collected movement data on only two females. Although we collected movement data on 7 males, three males (M2, M4, and Mll) traveled together as one group and their movements were not considered independent. In addition, the home range of male otter Ml was entirely outside of the study area. Numbers of locations were not sufficient to estimate seasonal home ranges for this otter because he was only accessible by aircraft and we conducted monitoring flights only once every other week. Male otter M6 spent most of his time outside the study area and was located only once per week; resulting in low samples sizes for calculating home range and daily movement estimates. Consequently, descriptive statistics were used to summarize home range lengths and ANOVA was performed to analyze seasonal consecutive-day movement patterns for each individual otter. Results of the statistical analysis must be viewed with caution because of these small sample sizes.

RESULTS

Home Range

Estimated annual home range lengths varied from 15.5-148.3 km (Table 9). Mean estimates for males (X = 106.3 km) were greater than those for females ($\bar{x}$ = 25.5 km). Home range estimates for male otters varied from 53.6-148.3 km compared to 15.5-26.5 km for females. Male otter M3 had substantially smaller home ranges, during all seasons, than the other 6 male otters. Home ranges of the remaining male otters varied from 103.2-148.3 km.

Home range lengths of male and female otters showed little seasonal variation (Appendix E). A trend toward larger spring and summer home range lengths, compared to fall and winter, was observed for male otters. Home range lengths tended to be smaller in winter and spring than summer and fall for female otters. Male seasonal home ranges remained larger than female home ranges during all seasons.

Table 9. Seasonal home range length estimates (km) and number of radiolocations (in parentheses) for instrumented river otters in the Cleawater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Animal ID	annual		Seasons: spring		summer		fall		winter	
Males:										
Ml	103.2	(21)	--		--		--		--	
M2	147.4	(219)	126.4	(40)	139.8	(51)	121.8	(44)	110.1	(28)
M3	53.6	(133)	47.0	(36)	35.1	(47)	17.6	(9)	29.0	(21)
M4	146.6	(188)	109.5	(39)	139.8	(50)	121.5	(44,	109.3	(32)
M6	104.9	(64)	74.9	(20)	73.6	(21)	77.3	(11)	47.9	(7)
Ml1	148.3	(136)	121.3	(29)	139.6	(51)	94.0	(44)	109.3	(12)
Ml2	122.4	(136)	109.3	(19)	119.1	(38)	90.9	(43)	7.8	(5)
$\bar{x}^a$	106.3		89.4		91.9		76.9		48.7	
Females:										
F8	15.5	(182)	12.3	(44)	15.5	(54)	12.0	(42)	8.8	(38)
F9	35.4	(170)	19.0	(34)	27.2	(52)	23.9	(47)	21.6	(33)
F10	26.5	(42)	--		--		--		--	
$\bar{x}^b$	25.5		15.7		21.4		18.0		15.2	

[a] Location data for otters M4 and Ml 1 were no! used to determne the x because they traveled with M2 as a group for the duration of the study. and their locations were not considered to be independent.

[b] Location data for otter F10 was not used to determine the x She was F9's young of the year and their locations were not considered to be independent.

Daily Movements

Estimates of mean consecutive-day movements calculated for the entire year ranged from 1.4-20.3 km (Table 10). Mean estimates for males ($\bar{x}$ = 11.6 km) were larger than those for females ($\bar{x}$ = 2.0 km), ranging from 5.4-20.3 km as compared to 1.4-2.5 km for females.

No strong seasonal patterns were evident in consecutive-day movements of male otters. Otter Ml2 was the only otter showing significant seasonal variation in daily movements, because of an extremely small movement index estimated during winter. However, this winter estimate is based on only 3 consecutive movements and is believed to be biased due to this small sample size. Ml2 showed no seasonal movement patterns for any of the other seasons. The mean daily movement index for all male otters was greater during spring than the other seasons, suggesting a general pattern of increased daily movements during spring.

Both instrumented adult female otters showed significant changes in seasonal movements. These animals had maximum daily movement indices during fall, and minimum indices during spring.

Table 10. Seasonal mean consecutiveday movement estimates (km) and number of consecutive locations (in parentheses) for implanted river otters in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Animal ID	annual		Season: spring		summer		fall		winter	
Males:										
M2	20.3	(95)	28.5	(22)	16.7	(35)	17.1	(29)	24.3	(9)
M3	5.4	(62)	7.0	(19)	4.4	(32)	3.3	(6)	8.5	(5)
M4	17.4	(100)	15.8	(23)	16.9	(35)	17.8	(4)	22.6	(13)
M6	8.6	(16)	4.2	(5)	6.5	(7)	17.0	(29)		(0)
M11	18.3	(88)	22.0	(17)	17.0	(35)			21.5	(7)
M12	12.5	(62)'	27.2	(9)a[1]	12.7	(22)a	8.9	(28)a	1.4	(3)a
$\bar{x}$[a]	11.6		16.7		10.1		11.8		11.4	
Females:										
F8	1.4	(105)"	0.7	(25)a	1.8	(38)ab	1.9	(23)ac	0.9	(19)ac
F9	2.5	(95)"'	0.6	(15)a	2.1	(37)b	4.0	(29)ab	2.7	(14)a
$\bar{x}$	2.0		0.7		2.0		3.0		1.8	

[a] Otters M4 and Ml 1 were not used to determine the $\bar{x}$ because they traveled with M2 as a group for the duration of the study, their locations were not considered to be independent.

' Significant differences in seasonal mean consecutive daily movements detected ($F_{3,59}$=5.22, P=0.0029).

Srgnifiiant differences in seasonal mean consecutive daily movements detected ($F_{,101}$=5.02, P=0.0027).

Significant differences in seasonal mean consecutive daily movements detected ($F_{3,92}$=6.95, P=0.0003).

[1] Values for seasons having the same letter are significantly different from each other (P<0.05).

DISCUSSION

Male otters in the Clearwater River moved extensively, while female otters tended to limit their movements to small sections of the river. Our results suggested the Clearwater River within the Reservation boundaries does not encompass an entire population of otters. Although the study area appears to support a core number of breeding otters, it is evident there is substantial interchange among other population centers within the drainage. Movements of instrumented otters strongly suggested regular interchange between otters in the Clearwater River with otters in the Selway and Lochsa Rivers, and the upper tributaries of Lolo Creek and the Potlatch River. Although instrumented otters rarely ventured into the South Fork of the Clearwater, we suspected there was some interchange between otters in the Clearwater River and otters in the South Fork and its tributaries, particularly Red River.

Interestingly, adult otter Ml was the only instrumented otter captured in the study area whose home range included the Snake River. Because Ml moved to the Snake River immediately after release and never returned to the study area, we suspected his normal home range was restricted to the Snake River and he was probably traveling outside of his normal home range in search of breeding females during spring when he was captured in the study area. None of the other instrumented otters were located in the Snake River. Unmarked otters were commonly sighted by the public along the Snake River upstream and downstream from the confluence with the Clearwater River, and we suspected there was some interchange of otters between the two rivers, as evidenced by Ml's movements during the breeding season.

Instrumented otters mostly used mainstem rivers and large tributaries within the study area. Otters spent the majority of their time in mainstem river habitats of the Clearwater, Selway, and Lochsa rivers. The Potlatch River received the most frequent use by instrumented otters of any large tributary in the study area. The South Fork Clearwater and Lolo Creek received only occasional use, and no radiolocations were obtained in Orofino or Clear creeks. Other than one location for female otter F9 in Lapwai Creek, none of the instrumented otters used small tributaries.

Radiolocation data for instrumented otters support the results obtained during sign surveys of tributary streams in the study area. Lolo Creek, South Fork Clearwater, and Potlatch River were the only large tributaries used by instrumented otters during our study. These were also the only large tributaries where otter sign was observed during sign surveys. Lolo Creek had the highest density of otter sign of any tributary stream surveyed. Even though Lolo Creek and the South Fork received only occasional use by instrumented otters, results of the mail survey and sign surveys suggested these tributaries received frequent use by other unmarked otters. In addition to observing sign in both of these tributaries, 76% of all sighting of otters reported in tributary streams, by respondents in the mail survey, were from these two tributaries.

Information gathered from the mail survey, sign surveys, and radio monitoring efforts suggested small tributaries receive little use by otters in the study area. Lapwai Creek was the only small tributary that supported a marginal year-round fishery. Although crayfish are abundant in all of these streams, low flows prevent their use by otters.

The Potlatch River received the most use by instrumented otters of any of the large tributary streams. Adult male otter M6's entire home range was encompassed by the Potlatch River. Male otter M3 included portions of the Potlatch River within his home range, and two adult female otters regularly used the lower 20 km of the Potlatch River. The lower Potlatch River supported the best developed riparian habitat of any stream in the study area. The river bottom was braided with many side channels and backwater sloughs. The vegetation was well developed with dense stands of Black Cottonwood (*Populus trichocarpa*) and either dense shrub or herbaceous understories.

Evidence suggested the Potlatch River may support important otter pup rearing habitat. During the 1994 breeding season 3 different female otters raised litters in the lower 10 km of the Potlatch River. Female otter F9 chose a natal den site in a steep, rocky, isolated tributary canyon to the Potlatch River. The den was situated in a natural rock cavity located approximately 8 km upstream from the mouth of the Potlatch River. F9 raised a litter of pups in this den for three consecutive years. During 1992, she gave birth to one pup around the first of April. F9 foraged for crayfish in the natal den area and made occasional trips to the Potlatch River during April and May when her pup was confined to the natal den. She was observed breeding in the Potlatch River on 3 April. The family group moved down to the Potlatch River around the first of June where they continued to forage predominately on crayfish for the remainder of the summer. Female otter F9 produced 3 pups in the same natl den in 1993. Unfortunately F9 died of unknown causes in June after she had moved her pups down to the Potlatch River in 1994.

As a yearling in 1992, otter F8 explored two natal dens (one in a secluded backwater slough along the Potlatch River and the other in a buried culvert along the Clearwater River just downstream from the mouth of the Potlatch River) but did not produce a litter. She was observed mating on 21 April of 1992. Female otter F8 returned to the same backwater slough during the 1993 breeding season. For unknown reasons she abandoned that den and selected a natal den in large highway riprap along the Clearwater River across from the mouth of the Potlatch River where she successfully raised 2 pups. In 1994, F8 returned and remained at the backwater slough natal den. Unfortunately, F8 was killed while crossing the highway while her pups were still confined to the natal den. An unmarked, lactating female otter was found dead on the highway in the same general area two weeks later.

Few studies have addressed home range and movements of natural otter populations. Additionally, existing reports have investigated otter populations from diverse geographic areas supporting different types of habitats, making comparisons between existing studies difficult. Melquist and Hornocker (1983) studied the ecology of a natural river otter population in a high mountainous valley in central Idaho. Foy (1984) studied the otter population in the J.D. Murphree Wildlife Management Area, a coastal marsh in southeastern Texas. Woolington (1984) studied the coastal otter population on Baranof Island in Alaska. Finally, Route and Peterson (1988) studied the distribution and abundance of river otters in the midwest lacusterine system of Voyageurs National Park in Minnesota. Not surprisingly, given the great variation in geographic range and habitats, a great deal of variation also exists in reported estimates of home range and movements.

In trying to characterize river otter movements from these studies, a few generalizations can be made. Home ranges of male otters tended to be larger than those reported for female otters during all (Melquist and Hornocker 1983, Foy 1984) or part (Route and Peterson 1988) of the year. Most studies reported a great deal of variation in seasonal home range size and few patterns were discernable for sex or age cohorts. Seasonal patterns may have been difficult to detect because of small sample sizes obtained for certain age and sex cohorts, and substantial variation reported for individual otters. The only seasonal trend common among all studies indicated that otters alter their home range size during the breeding season. However, the direction of the trend was not consistent among all studies. Both male and female otters tended to increase their home range in the coastal marsh of Texas (Foy 1984), while females tended to decrease their home range, to a natal den area, in central Idaho (Melquist and Hornocker 1983). Additionally, Woolington (1984) reported one adult male otter increasing his home range during the spring breeding season.

Home range overlap also appeared to vary among populations. Foy (1984), studying otters in lacustrine habitats of a coastal marsh, reported strong overlap between home ranges of opposite-sex pairs, but only slight overlap between same-sex pairs. He suggested his data supports the theory of intrasexual territoriality. Melquist and Hornocker (1983), however, reported great overlap in both inter- and intrasexual home ranges in Idaho, and suggested otters in his study area did not defend exclusive territories but rather at times maintained social groups through temporal and mutual avoidance. Woolington (1984) found no home range overlap between family groups of otters he studies in Alaska.

Similar to home range size estimates, substantial variation in mean consecutive-day movements between individuals and sex and age cohorts has been reported with no strong apparent seasonal patterns. Some researchers observed a trend indicating adult males traveled farther distances between consecutive-day locations during the breeding season (Woolington 1984, Route and Peterson 1988).

Our study of river otters in the Clearwater River, identified similar patterns in home range and consecutive-day indices as the studies summarized above. Male otters tended to maintain larger home ranges and move longer daily distances during all seasons than females. The increased movements observed for males during the spring and summer probably was related to adult males seeking breeding females. Both of the females we monitored were adult females who raised litters of otter pups during the study. Minimum spring and maximum fall movements observed for adult female otters was probably related to those females being tied

closely to the natal den area during early pup rearing, and increasing their movements as the pups developed through summer and fall.

Most authors reported food availability, at least for certain periods during the year, can have a strong influence on home range size, overlap, and movements of otters. An additional pattern in the literature suggested home range and movement patterns may be influenced by gross habitat configuration. River otter populations inhabiting strictly lacustrine habitats, such as those in the J.D. Murphree Wildlife Management Area in Texas and Voyageurs National Park in Minnesota, tend to move shorter daily distances within smaller home ranges. Also, home ranges tend to be non-overlapping, and otters are more prone to exhibit territoriality. In contrast, otter populations inhabiting primarily linear riverine habitats such as were found in the Payette drainage, tend to move greater daily distances in larger home ranges, and home ranges tend to overlap with little territorial behavior.

The results of our study supported the notion that gross habitat configuration influences otter home range and movement patterns. Unlike other studies of natural otter populations, our study area consisted solely of linear, riverine habitats. We would predict otters in the Clearwater River would move greater distances and maintain larger, overlapping, home ranges relative to those reported in the studies cited above. Furthermore, we would anticipate otter home range and movement patterns in the

Clearwater River would be more similar to results reported for otters in central Idaho, where a mix of lacustrine and riverine habitats occurred, than those reported in the strictly lacusterine habitats in Voyageur National Park or the J.D. Murphree Wildlife Management Area.

Mean home range lengths for males (106 km) were much larger and mean female home range lengths (26 km) were generally larger in this study than reported in the other studies. Woolington reported home ranges for family groups between 3-11 km and a maximum observed home range for an adult male of 23 km. Route and Peterson reported average winter and summer home range lengths for two study areas in Minnesota. Average male home ranges lengths ranged from 8-50 km for male and 10-23 km for female otters. Melquist and Hornocker's results were more similar to ours, reporting male home ranges lengths (63-78 km) that were intermediate between Clearwater otters and the rest of the studies, and female home range lengths (31-35 km) similar to those found for Clearwater otters .

A high degree of home range overlap occurred for otters in the Clearwater River (Appendix E). We found no evidence of intra- or intersexual territoriality. In the upper Clearwater River section, a group of five otters, including three instrumented males and presumable all males, traveled together and occupied 80 miles of the Clearwater River, a majority of the study area, for most of the year. Their home range overlapped with several other unmarked male and female otters also occupying that section of the river. Instrumented river otters in the lower Clearwater River section all exhibited home range overlap. Male otter M3's home range overlapped with two adult female otters, and the two adult female otters' *home* ranges overlapped as well.

Mean consecutive-day movements of male (il.6 km) and female (2.0 'km) otters in the Clearwater river were also greater than reported in other studies. Foy reported mean consecutive-day movements of 1.4 and 3.9 km respectively for male and female river otters in Texas. Route and Peterson reported seasonal consecutive-day movements for summer and winter between 1.2-3.4 km for male and between 1.0-1.4 for female otters. Mean consecutive-day movements for otters in Alaska were all less than 2 km and a maximum daily movement was reported as only 2.9 km. Again, our results were similar to Melquist and Hornocker's study, which reported movements for juvenile male (4.7-5.1 km) otters that were intermediate between those reported for the Clearwater River and the other studies. Movements for adult females (2.1-4.7) were similar to those reported for the Clearwater River.

HABITAT USE BY RIVER OTTERS IN THE CLEARWATER RIVER

INTRODUCTION

Because river otters inhabit a wide variety of habitats, characterizing important habitat parameters is difficult. Importance of particular otter habitat parameters vary among geographic areas and depend on a combination of factors including seasonal weather patterns, gross habitat configuration, vegetation and morphological habitat features, and available forage items. Therefore, river otter habitat is best assessed on a watershed basis. We assessed habitat use by instrumented otters in the Clearwater River to identify stream reaches important to river otters that could be protected or enhanced for otters.

In assessing habitat use of the Clearwater River by river otters, we: 1) characterized available river otter habitats, 2) characterized den sites used by otters, 3) characterized latrine sites used by otters, and 4) determined selection of available habitats by otters in the study area. Habitat use data was collected by monitoring movements of instrumented river otters. Ten otters were trapped, implanted with radio transmitters, and released in the study area. However, habitat use data could only be collected from six of these animals. Home ranges of three adult male otters (Ml, M6, and M12) were mostly outside of the study area and little habitat data could be collected for these animals. In addition, juvenile female Fl0 died from unknown causes five months after release, and year-round data could not be collected. Of the 6 otters for which year-round data was collected: three (M3, F8, and F9) maintained separate home ranges in the lower river section and habitat data was collected for each animal independently, while the other three (M2, M4, and Mll) traveled together as a group for most of the year in the upper river section and did not provide independent observations for habitat use data.

METHODS

Habitat Availability

River otter habitat in the study area was characterized by mapping bank vegetation (VEG) and bank substrates (BNK) along the Clearwater River and the first 5 km up from the mouth of tributary streams. Bank vegetation was classified by categorizing the overstory and understory into broad vegetation groups (tree, shrub, or herbaceous) and characterizing them as either dense or sparse (Appendix F). Bank substrate was generally classified according to particle size, and artificial riprap substrates were further identified as either highway or railroad and classified as either large or small (Appendix F).

Habitat availability was determined by calculating the total length of shoreline covered by each category for bank substrate and bank vegetation variables and summarizing results as proportions of each category found in the study area. Resulting frequency tables were used to re-code bank substrate and bank vegetation variables into fewer categories to eliminate low cell frequency counts and to aid in data interpretation. Re-coded categories for bank substrate (BNKl) and bank vegetation (VEGl) are listed in Appendix G. Chi-square analysis was used to compare the availability of habitats between lower and upper Clearwater River sections.

Habitat Use

<u>Denning Habitat</u> - Instrumented river otters were located daily during one of three 6-hour monitoring blocks (0600-1200 hrs., 1200-1800 hrs., and 1800-2400 hrs.). Monitoring blocks were rotated every week. Because the majority (81%) of radiolocations were collected while otters were inactive inside dens, only inactive locations for denning otters were used to assess denning habitat. Each den site used by instrumented otters was assigned a den type (Appendix F), and habitat variables associated at each den site were recorded including VEG, BNK, presence or absence of beaver activity (BVR), flow category (FLW), and waterway category (WWC) (Appendix F) . Den use by river otters was assessed by: 1) investigating use of different den types, and 2) characterizing denning habitats.

Otter use of different den types was investigated by recording the number of times instrumented otters used a different den type and calculating a den use index (the number of times a den type was used divided by the number of different dens of that type documented in the study area). Denning habitat was assessed by calculating the frequency for habitat variable categories associated with den sites, based on the number of times a den site was used by instrumented otters. One-way frequency tables for each variable were combined into two- and three-way frequency tables to assess associations between habitat variables. Two-way frequency tables combined bank substrate and bank vegetation habitat variables, and three-way frequency tables were constructed to combine flow, waterway category, and beaver sign variables. Use of habitat variables was compared between three river sections: upper and lower Clearwater River sections, and the Potlatch River.

<u>Latrine Site Habitat</u> - Variables measured to characterize habitat at 50 documented latrine sites are listed in Appendix F. In addition to variables recorded at otter dens, bank cover (COVl and COV2), bank slope (SLOP1 and SLOP2), land form (LNDFRM), and water depth (DEPTH) were also recorded. Data was summarized by constructing frequency tables for each variable. Chi-square tests were performed to compare habitats at otter latrine sites between the lower and upper Clear-water River sections.

Habitat Selection

Because we collected availability data for only bank substrate and bank vegetation, assessment of habitat selection was restricted to those two habitat variables. Habitat selection was assessed by comparing proportions of available bank substrate and bank vegetation habitat categories to proportions of those habitat variables used by instrumented river otters, as outlined by Neu et al. 1974). Habitat availability was determined by calculating the length of shoreline represented by each variable category using GIS analysis of mapped habitat variables, and expressing results in proportions. Habitat use was determined by calculating the frequency of habitat variable categories associated with radiolocations of inactive otters using GIS overlay analysis of radiolocation and mapped habitat variable coverages, and expressing results as proportions.

Habitat selection was assessed at two levels: 1) habitat use for all otters was compared to habitat availability within the study area, and 2) habitat use for individual otters was compared to proportions of available habitats within individual otter home ranges. Habitat use was determined for M3, F8, and F9 in the lower river section and M2 was selected to represent habitat use for the group of otters who maintained common home ranges in the upper river section. Smaller sample sizes for individual otters required that bank substrate and bank vegetation variables be re-coded and collapsed with fewer categories for statistical analysis. Categories for re-coded bank substrate (BNK2) and bank vegetation (VEG2) variables used in the habitat use analysis are listed in Appendix G.

RESULTS

Habitat Availability

Shorelines along the Clearwater River are dominated by rocky substrates Table 11. Over 70% of shoreline substrates are composed of either gravel and cobbles (36%) or riprap (35%). Sandy or organic soil substrates compose only 5% of the shoreline.

The proportions of bank substrates (BNKl) and bank vegetation (VEGl) are presented in Table 11. Bank substrates were similar between the lower and upper river sections. The majority of shoreline for both sections was composed of either gravel and cobble, rock, or riprap. However, the proportions of these substrates were significantly different ($P < 0.001$, 29% of cell with expected counts < 5) between sections. More shoreline was composed of large riprap in the upper section while more small riprap occurred in the lower section. In addition, there is more natural rock substrates along the lower section.

The most abundant vegetation found along the river were scattered tree overstories with sparse shrub understories (16.9%), sparse shrub overstories with sparse herbaceous understories (15.2%), and tree overstories with sparse shrub understories (12.2%). Generally, sparse or unvegetated habitat categories accounted for approximately 75% while dense habitat categories accounted for only 25% of all bank vegetation. Although 63% of all vegetation along the Clearwater River had tree overstories, about half were scattered trees and over 69% supported sparse understories. Shrub overstories accounted for most of the remainder of the vegetation along the river with sparse shrub overstories predominating (87%).

Table 11. Proportions of available bank substrate (BNK1) and vegetation (VEGl) for the lower and upper river sections, and the entire study area, within the Nez Perce Indian Resenfation, 1991-92.

Habitat variable/category	River Section (%) Lower	Upper	Study areh
Bank Substrate (BNKl)			
Organic	3.005	0.018	0.016
Sand	0.077	0.027	0.035
Gravel,cobble	3.406	0.397	3.357
Natural rock	3.17C	c. 397	0.154
Natural boulder	0.000	c.321	C.025
Small rigrap	3.252	C.168	0.212
Large riprap	0.090	C.274	0.136
Conglomerate			0.065
Bark vegezarion (VEG1)			
Tree overstory	0.000	C.005	0.003
Tree overstory/dense shrub	0.053	0.072	0.054
Tree overstoryisparse shrub	3.121	c.149	0.120
Tree overstory/dense herb	0.020	0.039	0.047
Tree overstoryisparse herb	3.015	0.037	0.080
Scattered tree overstory	3.000	0.007	0.004
Scattered tree overstory/dense shrub	0.046	C.027	0.028
Scattered tree overstoryisparse shrub	3.202	G.262	0.169
Scattered tree overstory/dense herb	3.018	0.C13	0.058
Scattered tree overstory/sparse herb	0.031	0.021	0.066
Dense shrub overstory	3.008	0.000	0.004
Dense shrub overstory/decse herb	0.049	0.003	0.019
Dense shrub overstory/sparse herb	0.011	0.007	0.012
Sparse shrub overstory	3.048	0.056	9.037
Sparse shrub 0verstory/dense herb	C.046	0.027	3.037
Sparse shrub overstory:sparse herb	0.217	0.183	0.152
Dense herb overstory	C.001	3.007	0.022
Sparse herb overstory	c.324	3.005	3.013
Unvegetated 0% canopy cover	C. 037	0.C57	0.036
Cnvegetated C-258 canopy cover	G.355	3.032	0.038

Proportions of bank vegetation were similar for the lower and upper Clearwater River sections. The three most common vegetation categories for both sections were tree overstories with sparse shrub understories, scattered tree overstories with sparse shrub understories, and sparse shrub overstories with sparse herbaceous understories.

Habitat Use

<u>Denning Habitat</u> - Instrumented river otters used 124 different dens during the course of the study. The distribution of dens sites is shown in fig. *8.* Documentation information is presented in Appendix H. Documented otter dens are summarized by reach and den type in Table 12. River otters in the Clearwater River used more (63%) rock cavities than any other den type. Railroad (24.2%) and highway (19.4%) riprap, natural rock (19.4%), and vegetation (12.9%) were the most common den types. Only 7 beaver dens (2 in the Potlatch River, 4 in the lower river section, and 1 not classified to reach) were documented to have been used by otters. Rock cavities were the most common den types in all sections of the study area. Where large riprap was available, otters tended to use those substrates most often for den sites. Along the Selway and Lochsa Rivers where no railroad and little highway riprap was available, otters used more natural rock cavities than any other den type. Otters denned in dense vegetation throughout all reaches of the study area.

The most abundant den types were also used most frequently by otters in the study area (Table 13). Den type category "other unnatural" received the highest den use index. "Other unnatural" dent types included abandoned log bunks filled with large rocks (n = 2), old culverts (n = 1), or riprap with large pieces of old cement used for fill (n = 1). Railroad riprap, highway riprap and natural rock cavities had the highest frequencies of use. Otters denned under vegetation least frequently.

Frequency of use for different den types varied among the lower and upper Clearwater River sections and the Potlatch River (Table 14) (chi-square = 91.174, 6 df, $P < 0.001$). Use of den types was similar between the lower and upper Clearwater River sections in that rock cavities were the most frequently used types. However, use of vegetation for denning sites was more frequent in the lower river section (chi-square = 11.23, 3 df, $P = 0.011$). Otters in the Potlatch River showed a different pattern of den type use than either the lower (chi-square = 86.726, 3 df, $P < 0.001$) or upper (chi-square = 55.08, 3 df, $P < 0.001$) Clearwater River sections. Otters in this section used more railroad riprap, less highway riprap, and less natural rock cavity den types than otters in the other two river sections.

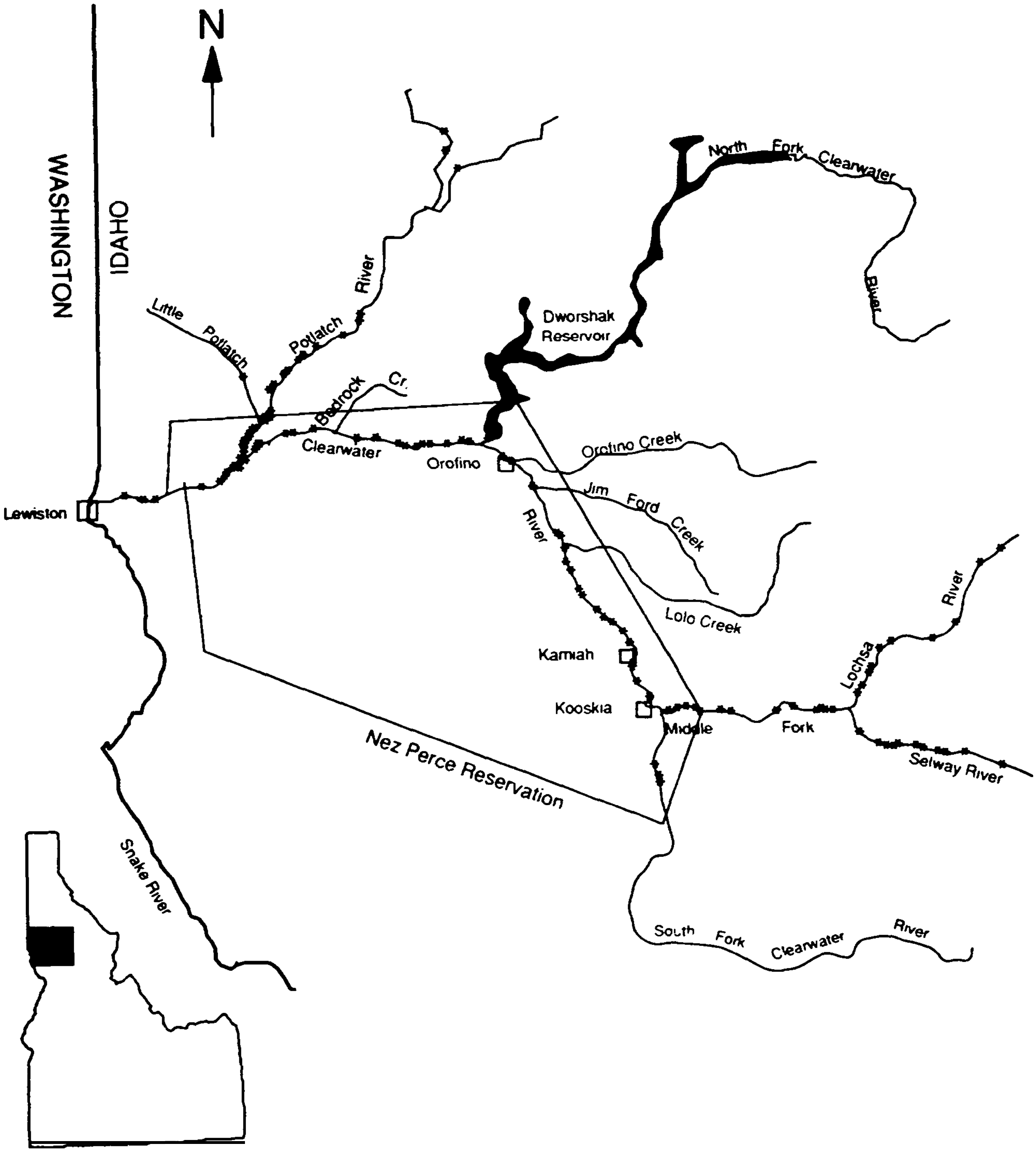


Fig. 8. Distribution of den sites used by instrumented river otters in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1992.

Table 12. Summarized results of otter den use in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Reach	Beaver dens		Rock cavity: Natural cavity		Rock cavity: Riprap: Highway		Rock cavity: Riprap: Railroad		Other unnatural		Other natural		Vegetation		Unclass-ified		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
LMCR[a]	4	(3.2)	2	(1.6)	9	(7.3)	6	(4.8)	3	(2.4)	1	(0.8)	5	(4.0)	-	-	30	(24.2)
NFCR[b]	-		1	(0.8)	-	-	-	-	1	(0.8)	-	-	-	-	-	-	2	(1.6)
UMCR[c]	-	-	1	(0.8)	5	(4.0)	11	(8.9)	-		-	-	2	(1.6)	-	-	19	(15.3)
SFCR[d]			-	-	-	-					2	(1.6)	1	(0.8)	-	-	3	(2.4)
MFCR[e]			4	(3.2)	4	(3.2)	-	-	-	-	1	(0.8)	2	(1.6)	-	-	11	(8.9)
LOCH[f]			6	(4.8)	2	(1.6)	-	-	-	-	-	-			-	-	8	(6.S)
SELW[g]	-	-	4	(3.2)	2	(1.6)	-	-	-	-	1	(0.8)	2	(1.6)	1	(0.8)	10	(8.1)
PTCH[h]	2	(1.6)	4	(3.2)	1	(0.8)	12	(9.7)	1	(0.8)	6	(4.8)	4	(3.2)	1	(0.8)	31	(25.0)
MFCR Trib.[i]	-	-	-		1	(0.8)	-	-	-	-	-	-	-	-	-	-	1	(0.8)
LOCH Trib.[j]	-	-	1	(0.8)	-	-	-	-	-	-	-	-	-	-	-		1	(0.8)
PTCH Trib.[k]	-	-	1	(0.8)	-	-	1	(0.8)	-	-	1	(0.8)	-	-	-	-	3	(2.4)
Unclass.[l]	1	(0.8)	-	-	-	-	-	-	-	-	-	-	-	-	4	(3.2)	5	(4.0)
Total	7	(5.6)	24	(19.4)	24	(19.4)	30	(24.2)	5	(4.0)	12	(9.7)	16	(12.9)	6	(4.8)	124	(100.0)

[a] LMCR = Lower mainstem Clearwater River
[b] NFCR = North Fork Clearwater River
[c] UMCR = Upper mainstem Clearwater River
[d] SFCR = South Fork Clear-water River
[e] MFCR = Middle Fork Clear-water River
[f] LOCH = Lochsa River
[g] SELW = Selway River
[h] PTCH = Potlatch River
[i] MFCR Trib. = Tributaries of the Middle Fork Clearwater River
[j] LOCH Trib. = Tributaries of the Lochsa River
[k] PTCH Trib. = Tributaries of the Potlatch River
[l] Unclass. = Unclassified den type

Table 13. Number (n), frequency of use, and den use index (Index) for different den types used by instrumented otters in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Den Type	n	Freauencv n	%	Index'
Beaver	7	33	3.7	4.7
Natural rock cavity	24	157	17.5	6.5
Highway riprap	24	219	24.4	9.1
Railroad riprap	30	317	35.3	10.6
Other unnatural	5	59	6.6	11.8
Other natural	12	34	3.8	2.8
Vegetation	16	80	8.9	5.0
Unclassified	6			

[a] Den use index = frequency / n

Table 14. Comparison of frequency of use (n) of the most abundant otter den types between the lower (LCR) and upper (UCR) river sections and the Potlatch River in the Cleamater River drainage within the Nez Perce Indian Reservation, Idaho, 1992.

	Den type									
	Natural rock		Highway riprap		Railroad riprap		Vege-tation		Total	
Section,	n	%	n	%	n	%	n	%	n	%
LCR	62	19	120	36	108	32	45	13	335	100
UCR	35	14	87	35	109	44	19	8	250	100
Potlatch R.	12	10	3	3	96	80	10	8	121	100

[a] All three river sections significantly different from each other ($P < 0.05$).

Summarized results of denning habitat assessment are presented in Appendix I. Habitats most frequently associated with den sites were similar to the most abundant habitats available in the study area. The most common bank substrates associated with den sites were large railroad riprap, large highway riprap, and natural rock (Appendix I-l). The most frequent bank vegetation types associated with den sites were unvegetated and sparse shrub overstory with sparse herbaceous understory. Two-way frequency tables showed unvegetated and sparse shrub overstory with sparse herbaceous understory vegetation categories were associated with large highway and railroad riprap types (Appendix I-2). Three-way frequency tables indicated that otters used dens along mainstem habitats not associated with beaver sign, and in a variety of flow categories including main current, eddy/pool, and rapids/riffles (Appendix I-2).

Denning habitats were similar between the lower and upper Clearwater River sections and did not vary from patterns observed for the entire study area (Appendix I-3 to I-6). Denning habitats for otters using the Potlatch River differed from both the lower and upper river sections. The most frequent bank substrates at Potlatch River dens sites were large railroad riprap and organic (Appendix I-7). The most abundant bank vegetation included dense shrub and dense herbaceous categories. Two-way frequency tables showed that the most frequent bank vegetation and substrate combinations were large railroad riprap substrates associated with either dense shrub or dense herbaceous vegetation categories (Appendix I-8). Three-way frequency table showed that otters denning in this section located den sites most often along eddy and pools in either slough or mainstem habitats not associated with beaver sign (Appendix I-8).

Latrine Site Habitat - Habitat assessment results for documented otter latrine sites are listed in Appendix J. Most latrine sites were located in eddies (668) along either convex (52%) or straight (26%) shorelines of either mainstem (n = 36) or side channel slough (n = 10) habitats of the Clearwater River. All latrine sites located in side channel sloughs occurred in the lower river section. Haul-outs to latrine sites were mostly shallow (< 50 cm) with flat contours below the waterline (64%) and either shallow sloping (50%) or steep sloping (28%) banks. Sign of beaver activity was observed at over 60% of documented latrine sites.

More than half (58%) of documented latrine sites were located in either sand or large riprap bank substrates. Otter latrine sites were associated with a variety of vegetation categories; the two most frequent were sparse shrub overstory with sparse herb understory and unvegetated. Bank vegetation at latrine site located on sandy substrates was mostly (77%) either dense shrub or dense herbaceous. Latrine sites located on rocky substrates were mostly (75%) associated with either no or sparse vegetation. Hiding cover was low at all latrine sites regardless of bank substrate or vegetation. Visibility at 1.5 m from latrine sites was greater than 50% at 82% of the sites. Visibility at 4.5 m from latrine sites was greater than 75% at 74% of the sites.

Documented latrine sites were generally evenly distributed between the lower (n=29) and upper (n=21) Clearwater River sections. Chi-square analysis did not detect any differences in habitat patterns associated with latrine sites between the two river sections.

Habitat Selection

Bank Substrate - Instrumented river otters displayed definite use patterns for bank substrates (BNK1) in the study area (Table 18). Of the four most common substrates comprising 86% of all available substrates, gravel and cobble were avoided and natural rock and large riprap were preferred when data from all otters were analyzed. Although sand occurs infrequently in the study area, it was used greater than expected.

Although some variation in individual preferences for bank substrates (BNK2) was evident, habitat use patterns for bank substrates were generally similar among all otters (Tables 19 and 20). Gravel and cobble substrates were avoided by all otters. Large riprap substrates were used more than their availability by all otters, and significantly so for M2 and F9. Natural rock substrates were preferred by otters M3 and F8, but used less than the available proportion within otter M2's home range, and significantly so for F9. Finally, sand substrates were used in greater proportion than their availability for all otters but only significantly so for otter F8.

Bank Vegetation - Use of bank vegetation was variable and no patterns were discernable. For all otters combined, 11 of 17 bank vegetation categories were used significantly more or significantly less than expected (Table 15). Of the 20 different bank vegetation (VEG1) categories, 57% of all radio locations of otters were in only two categories: scattered tree overstory with sparse shrub understory and sparse shrub overstory with sparse herb understory. These two vegetation categories were also the two most abundant vegetation category and both were used greater than expected. The third most common vegetation category in the study area, tree overstory with sparse shrub was used less than expected.

Use of bank vegetation by otters M2 and M3 (Table 16), and F8 and F9 (Table 17) were also variable. The three most abundant bank vegetation (VEG2) categories were the same for all animals: tree overstory with sparse shrub understory, sparse shrub overstory with sparse herb understory, and tree overstory with dense shrub understory. However, use of these vegetation categories varied by animal. Adult male otters in the upper river section used sparse shrub overstory with sparse herbaceous understory vegetation more than expected. Adult male otter M3 used tree overstory with sparse shrub understory more than expected and tree overstory with dense shrub understory less than expected. Adult female otter F8 used tree overstory with dense shrub more than expected, and sparse herb overstory less than expected. Adult female otter F9 used tree overstory with sparse shrub less than expected and sparse shrub overstory with sparse herb understories more than expected.

Table 15. Proportions in study area, expected and observed use, observed proportion and simultaneous confidence intewals for use of bank vegetation (VEG1) by inactive river otters in the Cleatwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. Utilization is based on 780 locations of 10 instrumented otters.

Bank vegetation Category	Proportion in study area (%)	Expected use (n)	Observed use (n)	Observed proportion (%)	Bonferroni
Scattered tree overstory/sparse shrub	0.169	131.783	210	0.269	0.221 < P < 0.317 •
Sparse shrub overstory/sparse herb	0.152	i18.835	234	0.300	0.250 < P < 0.350 *
Tree Overstory/sparse shrub	0.122	95.360	35	0.045	0.023 < P < 0.367 •
Tree Overstory/sparse herb	0.080	62.530	3	0.004	0.000 < P < 0.011 •
Scattered tree overstory/sparse herb	0.066	51.211	25	0.032	0.013 < P < 0.051 •
Scattered tree overstory/dense herb	0.058	45.553.	4	0.005	0.000 < P < 0.013 •
Tree overstory dense shrub	0.054	42.020	39	0.050	0.026 < P < 0.074
Tree Overstory dense herb	0.047	36.468	18	0.023	0.007 < P < 0.039 •
Unvegetated 0-25% canopy cover	0.038	29.673	2	0.003	0.000 < P < 0.009 *
Sparse shrub overstory	0.037	28.599	31	0.040	0.019 < P < 0.061
Sparse shrub overstory/dense herb	0.337	28.509	22	0.028	0.010 < P < 3.046
Unvegetated 0% canopy cover	0.333	25.625	16	0.021	0.005 < P < 3.037
Scattered tree overstory/dense shrub	0.028	21.880	84	0.108	0.074 < P < 0.142 •
Dense herb overstory	0.022	17.117	5	0.006	0.000 < P < 0.014 •
Dense shrub overstory/dense herb	0.019	14.428	41	0.053	0.029 < P < 0.077 *
Sparse herb overstory	0.313	9.759	6	0.008	0.000 < P < 0.018
Dense shrub overstory/sparse herb	0.012	9.588	3	0.004	0.000 < P < 0.011 *
Dense shrub overstory	0.004	3.311	0	0.000	
Scattered tree overstory	0.004	3.249	0	0.000	
Unvegetated	0.003	2.544	2	0.003	0.030 < P < 0.009
?ree overstory	0.003	1.975	3	0.000	
Total	1.co3	780.000	780	1.000	

• indicates significant difference (P < 0.05).

Table 16. Proportions in home range, expected and observed use, observed proportion and simultaneous confidence intervals for use of bank vegetation (VEG2) by inactive male river otters in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. Utilization is based on 179 locations for otter M2 and 80 locations for otter M3.

Otter id Bank vegetation category	Proportion in home range (%)	Expected use (n)	Observed use (n)	Observed proportion (%)	Bonferroni	
M2						
Tree overstory sparse shrub	0.412	73.819	68	0.380	0.281 < P < 0.479	
Sparse shrub overstory sparse herb	0.171	30.67:	58	0.324	0.228 < P < 0.420	*
Tree overstory dense shrub	0.147	26.286	17	[illegible]	0.035 < P < 0.155	
Sparse herb overstory	0.082	14.724	11	0.061	0.012 < P < 0.110	
Unvegetated	3 373	13.129	7	0.039	0.000 < P < 0.079	
Dense shrub overstory	0 357	10.261	15	0.084	0.027 < P < 0.141	
Dense herb overstory	0.045	7.976	3	0.017	0.000 < P < 0.043	*
Tree overstory	0.012	2.134	0	[illegible]		
Total	1.000	179.000	179	1.000		
M3						
Tree overstory sparse shrub	0.309	24.744	42	0.525	0.375 < P < 0.675	*
Sparse shrub overstory sparse herb	0.239	19.087	21	0.263	0.131 < P < 0.395	
Tree overstory dense shrub	0.229	18.301	10	0.125	0.026 < P < 0.224	*
Dense shrub overstory	0.073	5.879	6	0.075	0.000 < P < 0.154	
Dense herb overstory	0.066	5.301	1	0.013	0.000 < P < 0.047	*
Unvegetated	0.057	4.569	3	0.000		
Sparse herb oversrory	0.027	2.120	0	0.000		
Total	1.000	80.000	80	1.000		

* indicates significant difference (P < 0.05).

Table 17. Proportions in home range, expected and observed use, observed proportion and simultaneous confidence intervals for use of bank vegetation (VEG2) by inactive female river otters in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. Utilization is based on 176 locations for otter F8 and 63 locations for otter F9.

Otter id Bank vegetation category	Proportion in home range (%)	Expected use (n)	Observed use (n)	Observed proportion (%)	Bonferroni
F8					
Tree overstory/sparse shrub	0.117	73.424	73	0.415	0.315 < P < 0.515
Sparse shrub overstory/sparse herb	0.178	31.297	22	0.125	3.058 < P < 0.192
Tree overstory/dense shrub	0.164	28.854	58	0.330	0.235 < P < 0.425 •
Dense shrub overstory	0.106	18.713	21	0.119	0.053 < P < 0.185
Unvegetated	0.062	10.953	0	0.000	
Sparse herb overstory	0.052	9.091	2	0.011	0.000 < P < 0.032 *
Dense herb overstory	0.021	3.668	0	0.000	
Total	1.000	176.000	176	1.000	
F9					
Tree--overstory/sparseshrub	0.325	20.497	6	0.095	0.000 < P < 0.194 *
Tree overstory/dense shrub	0.182	11.447	11	0.175	0.046 < P < 0.304
Sparse shrub overstory/sparse herb	0.167	10.513	30	0.476	0.307 < P < 0.645 •
Dense herb overstory	0.166	10.452	8	0.127	0.014 < P < 0.240
Dense shrub overstory	0.071	4.494	7	0.111	0.005 < P < 0.217
Sparse herb overstory	0.054	3.371	0	0.000	
Unvegetated	0.035	2.226	1	0.016	0.000 < P < 0.059
Total	1.000	63.000	63	1.000	

• indicates significant difference (P < 0.05).

Table 18. Proportions in study area, expected and observed use, observed proportion and simultaneous confidence intervals for use of bank substrates (BNK1) by inactive river otters in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. Utilization is based on 780 locations of ten instrumented otters.

Bank substrate category	Proportion in study area (%)	Expected use (n)	Observed use (n)	Observed proportion (%)	Bonferroni
Gravel/cobble	0.357	278.656	141	0.181	0.143 < P < 0.219 *
Small riprap	0.212	164.975	195	0.250	0.208 < P < 0.292
Natural rock	0.154	120.037	151	0.194	0.155 < P < 0.233 *
Large riprap	0.136	105.948	227	0.291	0.246 < P < 0.336 *
Conglomerate	0.065	50.695	5	0.006	0.000 < P < 0.014 *
Sand	0.035	27.270	56	0.072	0.050 < P < 0.094 *
Natural boulder	0.025	19.693	1	0.001	0.000 < P < 0.004 *
Organic	0.016	12.725	4	0.005	0.000 < P < 0.012 *
Total	1.000	780.000	780	1.000	

. Indicates significant difference ($P < 0.05$).

Table 19. Proportions in home range, expected and observed use, observed proportion and simultaneous confidence intervals for use of bank substrates (BNK2) by inactive male river otters in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. Utilization is based on 179 locations for otter M2 and 80 locations for otter M3.

Otter id Bank substrate category	Proportion in home range (%)	Expected use (n)	Observed use (n)	Observed proportion (%)	Bonferroni	
M2						
Gravel cobble	0.387	69.348	32	0.179	0.103 < P < 0.225	*
Small riprap	0.242	43.243	34	0.190	0.113 < P < 0.267	
Large riprap	0.162	28.940	78	0.436	0.338 < P < 0.534	*
Natural rock	0.133	23.755	23	0.128	0.005 < P < 0.206	
Organic'sand	0.059	10.584	12	0.067	0.018 < P < 0.116	
Natural boulder	0.017	3.130	0			
Total	1.000	179.000	179	1.000		
M3						
Gravel cobble	0.440	35.178	20	0.250	0.125 < P < 0.375	*
Small riprap	0.337	26.928	27	0.338	0.202 < P < 0.474	
Natural rock	0.136	10.895	22	0.275	0.146 < P < 0.404	*
Organic'sand	0.075	5.984	7	0.088	0.006 < P < 0.170	
Large riprap	0.013	1.014	4	0.050	0.000 < P < 0.113	
Total	1.000	80.000	80	1.000		

* indicates significant difference ($P < 0.05$).

Table 20. Proportions in home range, expected and observed use, observed proportion and simultaneous confidence intervals for use of bank substrates (BNK2) by inactive female river otters in the Clearwater River within the Nez Perce Indian Resewation, Idaho, 1991-92. Utilization is based on 176 locations for otter F8 and 63 locations for otter F9.

Otter id Bank Substrate category	Proportion in home range (%)	Expected use (n)	Observed use in)	Observed proportion (%)	Bonferroni	
F8						
Gravel.cobble	0.396	69.658	14	0.080	0.027 < P < 0.133	*
Natural rock	0.282	49.589	69	0.392	0.297 < P < 0.487	•
Small riprap	0.268	47.207	63	0.358	0.265 < P < 0.451	
Organic/sand	0.031	5.536	23	0.131	0.066 < P < 0.196	*
Large riprap	0.023	4.009	7	0.040	0.002 < P < 0.078	
Total	1.000	176.000	176	1.000		
F9						
Gravel'cobble	0.454	28.574	12	0.190	0.063 < P < 0.317	*
Natural rock	0.319	20.102	9	0.143	0.029 < P < 0.257	*
Small riprap	0.152	9.564	3	0.048	0.000 < P < 0.117	•
Organic/sand	0.043	2.690	4	0.063	0.000 < P < 0.142	
Large riprap	0.033	2.070	35	0.556	0.395 < P < 0.717	*
Total	1.000	63.000	63	1.000		

* indicates significant difference (P < 0.05).

DISCUSSION

The riparian zone along the Clearwater River is a narrow, poorly developed band of vegetation contained between the river and State Highway 12 on the south and the Camas Prairie Railroad on the north side. Vegetation within the riparian zone is dominated by scattered tree or sparse shrub overstories and sparse understories growing in either gravel, cobble, or riprap substrates. Pockets of scattered or sometimes denser stands of Ponderosa Pine *(Pinus* Ponderosa) with either sparse shrub or sparse herb understories are found where the highway or railroad pull away from the river. Isolated stands of Black Cottonwood (*Populus trichocarpa*) with dense herbaceous understories develop at the mouths of tributary streams. In general, patterns of bank substrate and vegetation are similar for both the lower and upper river sections.

Our assessment of habitat use by river otters in the Clearwater River suggested otters chose denning and latrine sites based on the suitability of bank substrates more than other habitat parameters. For both den and latrine sites there was only weak associations with bank vegetation and other measured habitat variables. Further there was no discernable pattern in selection for bank vegetation categories. However, there was a strong correlation for den and latrine sites with bank substrates. Large riprap substrates accounted for 35% of the available substrates, and 43.6% of documented den sites and 35% of documented latrine sites were located in this substrate type.

Otters preferred large riprap, natural rock, and sand substrates for denning and latrine sites. One notable difference between site selection for latrine sites and denning sites is beaver sign was present in over 60% of latrine sites compared to 21% of den sites. A typical location for either an otter den or latrine site along the Clearwater River would be a large natural boulder or riprap outcrop projecting into the river. These outcrops would normally form an eddy with an associated sandy beach on the downstream side of the outcrop. The large substrate would provide denning cavities, while the sand beach would provide rolling and grooming sites and the eddy would provide a good foraging area.

Our analysis suggested denning habitats in the Potlatch River are different than those in the Clearwater River. Otters in the Potlatch tended to use dens more often associated with denser vegetation, organic substrates, eddy or pool flow categories, and slough waterway categories. These differences may be explained by the differences in availability of those habitats between the Potlatch and Clearwater rivers. Large railroad riprap substrates were used most frequently for den sites in the Clearwater and Potlatch River. However, unlike the Clearwater River, much of the railroad embankment along the Potlatch River was covered with dense blackberry bushes, accounting for the higher frequency of dense vegetation associated with den sites in this section. Additionally, there were more slough and side channel habitats along the lower Potlatch River than the Clearwater River, and otters used these areas extensively. Consequently, more otter dens in the Potlatch River were located in sloughs which were associated with organic bank substrates and dense vegetation types.

DIET COMPOSITION OF RIVER OTTERS IN THE CLEARWATER RIVER

INTRODUCTION

To better understand how otters use habitats in the Clearwater River, important prey items of otters were identified. From identified prey remains found in collected otter scats, we determined a list of prey items consumed by otters, identified the relative frequency of use of prey items, and looked at temporal and spatial changes in diet composition of river otters in the study area.

METHODS

River otter scat was collected during radiotracking efforts and monthly latrine site surveys from January - December 1992. Diet composition of river otters was determined by identifying all prey remains found in collected scat. The relative proportion each prey item contributed to the overall diet was determined by the frequency each item was found across all samples.

Collected scats were processed using the procedures outlined by Mack (1985). Samples were washed in nylon sample bags in a conventional clothes washing machine. Washed samples were then dried in a convection oven for 24 hours at 50" C. Processed samples contained clean bone and scale remains of ingested prey items. Prey remains were examined under a binocular dissecting microscope to identify prey items. All prey items identified in a sample were recorded. However, since no quantitative measure of the numbers of each prey item present in a sample could be made, only presence was recorded such that identified prey items were only recorded once for each collected scat.

Results are first presented as simple frequency of occurrence for each prey item for the entire river and over the entire collection period, which lists all prey items consumed by river otters in the study area. Secondly, seasonal changes and differences between three river sections for diets of crayfish and identified fish species was investigated. Identified fish species were grouped by family except for whitefish, which were analyzed separately from other salmonids because they accounted for a large proportion of the otters' diet. Two-way frequency tables were examined and Chi-square tests were performed to detect differences in: 1) seasons for the entire river, 2) seasons within each section, and 3) three river sections (upper Clearwater River section, lower Clearwater River section, and Potlatch River). Finally, Chi-square tests were performed to detect differences in proportions of crayfish and all identified fish combined within seasons.

RESULTS

Results were based on 1,367 samples of collected otter scat, including 880 samples from the lower Clearwater River, 307 samples from the upper Clearwater River, 75 samples from the Potlatch River, and 105 samples from other sites within the study area. Of the sample of identified fish and crayfish, 74% came from the lower section, 22% from the upper section, and only 5% from the Potlatch River.

Diet Composition

Fish, invertebrate, bird, and mammal prey remains were identified (Table 21). Fish-comprised 79% of all identified prey items. Crayfish was the only invertebrate identified and also comprised a substantial (20%) proportion of the sample. Birds (0.4%) and mammals (0.06%) were considered infrequent prey items of otters in the Clearwater drainage.

Fish were by far the most frequently identified prey item. Fish families identified included Catostomidae, Salmonidae, Cottidae, Cyprinidae, and Centrachidae. Catostomid species could not be differentiated by prey remains found in scat samples. Bridgelip (Catostomus columbianus) and largescale (C. *macrocheilus)* suckers were common in the study area (Simpson and Wallace 1982) and both are believed to be otter prey.

Mountain whitefish *(Prosopium williamsoni)* was the only species that could be differentiated from the rest of the salmonids by prey remains found in otter scats. Mountain whitefish (8.9%) were recorded as frequently as all other salmonids combined (7.9%). Other salmonids occurring in the study area that could not be differentiated during examination of prey remains in otter scat, included steelhead salmon *(Oncorhynchus mykiss),* chinook salmon (0. tshawytscha), rainbow trout *(Salmo gaircheri),* and cutthroat trout *(Salmo clarki)* (Simpson and Wallace 1982).

Sculpins also could not be identified to species, however, several species occurred in the study area, including torrent sculpins *(Cottus* rhotheus), mottled sculpins (C. bairdi), shorthead sculpin *(C. confusus),* and Paiute sculpins (C. *beldingi)* (Simpson and Wallace 1982).

Several cyprinid species were identified, including red side shiner *(Richardsonius* balteatus) (O-8%), longnose dace *(Rhinichthys cataractae)* and speckled dace (R. osculus) (O-9%), northern squawfish *(Ptychocheilus oregonensis)* (O-4%), carp (*Cyprinus carpio)* (0.6%), and chiselmouth *(Acrocheilus alutaceus)* (0.3%).

Centrarchids were difficult to identify to species, however, a few scat sampled included prey remains with sufficient characteristics to identify smallmouth bass (Micropterus *dolomieui),* black crappie *(Pomoxis nigromaculatus),* and blue gill *(Lepomis macrochirus).*

Table 21. Diet composition of river otters determined by prey remains identified in river otter scat collected during monthly surveys along the Clearwater River within the Nez Perce Reservation, Idaho, 1991-1992.

3rey item	Frequency of occurrence n	%
Fish		
Catostomidae		
Catostomcs spp. (large scale & bridgelip sucker)	407	25.5
Salmonidae		
Prosopium ***williarnsoni*** (mountain whitefish)	140	8.8
Unidentified salmonids (salmon, trout, chars)	123	7.8
Subtotal	263	16.6
Cottidae		
Unidentified Cottus spp. (sculpin)	125	7.8
Cyprinidae		
Richardsonius balteatus (red side shiner)	13	0.8
Rhinichthys ***spp.*** (dace)	14	0.9
Ptychoctieil***us oregonensis*** (northern squawfish)	7	0.4
Unidentified Cyprinids (chiselmouth, carp)	49	3.1
Subtotal	96	5.2
Centrarchidae		
Micropterus dolomieu (small mouth bass)	5	c.3
Pomoxis nigromaculatus (black crapie)	2	c.1
Lepomis macrochirus **(blue** gill)	4	0.3
Unidentified centrarchids	63	4.0
subtotal	74	4.7
Unidentified Fish		
Unidentified fish species	***298***	18.7
Invertebrates		
Astacus ***spp.*** (crayfish)	310	19.5
Mammals		
Unidentified mammals	1	0.1
Birds		
Unidentified birds	7	0.4
Other		
Unidentified other	12	0.8

When considering only identified fish families, catostomids were most frequently recorded comprising 42% of all identified fish species (Table 22). Salmonidae was the next most frequently recorded fish family, comprising 27% of identified fish prey remains. Cottidae (13%), Cyprinidae (10%), and Centrachidae (8%) were recorded less frequently. Although crayfish were observed in only 24% of the scats sampled, they ranked second in frequency of occurrence behind suckers (33%) with salmonids comprising the third most frequent (21%) prey item, when considering proportions of fish and crayfish in the sample (Table 22).

Table 22. Diet composition of river otters based on identified prey items found in river otter scat collected during monthly surveys along the Cleawater River, within the Nez Perce Indian Reservation, Idaho, 1991-1992.

Prey item	Frequency	All prey (%)	Fish only (%)
Catostomidae	407	32	42
Salmonidae	263	2i	27
Cottidae	125	10	13
Cyprinidae	96	8	10
Centrarchidae	74	6	8
subtotal	965		100
Astacus spp. (crayfish)	310	24	
total	1275	100	

<u>Diets Within River Sections</u> - Composition of prey items found in otter scats was significantly different between all three sections (Table 23). The upper Clearwater River section was different from the lower Clearwater River section (Chi-square = 37.6, 6 df, $P < 0.001$) and the Potlatch River (Chi-square = 46.9, 6 df, $P < 0.001$). The Potlatch River and the lower Clearwater River section also differed (Chi-square = 70.2, 6 df, $P < 0.001$).

Potlatch River. Crayfish (41%), cyprinids (22%), and centrarchids (17%) comprised the three most frequent prey items in diets of otters foraging in the Potlatch River. Use of salmonids and catostomids (<10%) was substantially less than that reported for the Clearwater River sections. Whitefish were not identified in any scats collected from the Potlatch River. Cottids were represented with similar (7%) frequency as the two Clearwater River sections.

Table 23. Frequency of occurrence (n) of identified fish families and crayfish found in samples of river otter scat collected during monthly scat surveys along three sections of the Cleat-water River within the Nez Perce Indian Reservation, Idaho, 1991-92.

	Section		
	Lower[1]	Potlatch[2]	Upper[3]
Prey item	n (%)	n (%)	n (%)
Catostomidae	276 (32)	4 (07)	102 (41)
Salmonidae	171 (20)	3 (06)	74 (29)
Cottidae	91 (11)	4 (07)	17 (37)
Cyprinidae	63 (07)	12 (22)	15 (06)
Centrarchidae	45 (05)	9 (17)	18 (07)
Astacus spp.	215 (25)	22 (41)	25 (10)
Total	861(100)a[4]	54(100)ab	251(100)ab
Al: fish	646 (75)	32 (59)	226 (90)
Astacus spp.	215 (25)	22 (41)	25 (10)
Total	861(100)a	54(100)ab	251(100)ab

[1] Lower - Lower Clearwater River section from it's mouth at Lewiston upstream to it's confluence with the North Fork Clearwater River at Orofino.

[2] Potlatch - Potlatch River

3 Upper - Upper Clearwater River section from it's confluence with the North Fork Clearwater River at Orofino upstream to the eastern reservation-boundary near Kooskia.

a Values for seasons having the same letter are significantly different from each other (P < 0.05).

Lower Clearwater River. Catostomids (32%), crayfish (25%), and salmonids (20%) comprised the three most frequent prey items identified in the diets of otters foraging in the lower Clearwater River section. Cyprinids and centrarchids contributed only a small proportion (<10%) to the diet of otters foraging in this section, and the proportion of cottids found in the diet were similar to the other two sections (11%).

Upper Clearwater River. Catostomids (41%), salmonids (30%), and crayfish (10%) comprised the three most common prey items identified in scats collected from this river section. Centrarchids and cyprinids were minor proportions (<10%) of otter diets from this section, and the proportion of cottids found in the diet were similar to the other two sections (7%)

Proportions of fish and crayfish were significantly different between all sections (Chi-square = 36.0, 2 df, $P < 0.001$) (Table 23). Proportions of crayfish in the diet in the upper section was significantly lower than in the lower section

(Chi-square = 35.9, 1 df, P < 0.001) and Potlatch River (Chi-square = 32.3, 1 df, P < 0.001). In addition the frequency of crayfish in the diet was also **significantly greater in the Potlatch River than the lower section (Chi-square = 6.6, 1 df, P < 0.01).**

Table 24. Seasonal frequency of occurrence (n) of identified fish families and crayfish found in samples of river otter scat, collected during monthly scat surveys along three sections of the Cleamater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

	Season							
	Spring		Summer		Fall		Winter	
Section/Prey item	n	(%)	n	(%)	n	(%)	n	(%)
Study Area								
Catostomidae	52	(29)	53	(20)	120	(38)	181	(37)
Salmonidae	68	(38)	57	(21)	47	(15)	90	(19)
Cottidae	20	(11)	27	(10)	29	(09)	49	(10)
Cyprinidae	16	(09)	24	(09)	20	(06)	36	(07)
Centrarchidae	7	(04)	15	(06)	18	(06)	34	(07)
Astacus spp.	14	(08)	5	(35)	84	(26)	93	(19)
Total	177	(100)a[1]	271	(100)ab	318	(100)ab	483	(100)ab
All fish	163	(92)	176	(65)	234	(74)	390	(81)
Astacus spp.	14	(08)	95	(35)	84	(26)	93	(19)
Total	177	(100)a	271	(100)ab	318	(100)abc	483	(100)abc
Lower*								
Catostomidae	25	(29)	36	(22)	86	(34)	128	(35)
Salmonidae	27	(32)	45	(28)	43	(17)	55	(15)
Cottidae	11	(13)	18	(11)	19	(08)	43	(12)
Cyprinidae	8	(09)	10	(06)	18	(07)	27	(07)
Centrarchidae	1	(01)	7	(04)	10	(04)	27	(07)
Astacus spp.	13	(15)	47	(29)	74	(30)	81	(22)
Total	85	(100)a	163	(100)b	250	(100)ab	361	(100)ab
Upper[b]								
Catostomidae	23	(28)	12	(34)	34	(58)	33	(44)
Salmonidae	40	(49)	6	(17)	4	(07)	24	(32)
Cottidae	8	(10)	1	(03)	6	(10)	2	(03)
Cy-prinidae	5	(06)	3	(09)	1	(02)	6	(08)
Centrarchidae	6	(07)	1	(03)	8	(14)	3	(04)
Astacus spp.	0	(00)	12	(34)	6	(10)	7	(09)
Total	82	(100)	35	(100)	59	(100)	75	(100)

[a] Lower - Mainstem Clearwater River from it's mouth at Lewiston upstream to it's confluence with the Norm Fork Clearwater River at Orofino. Sample sizes were too low to determine seasonal changes in otter diets.

[b] Upper - Mainstem Clearwater River from it's confluence with the North Fork Clearwater River at Orofino upstream to the eastern reservation boundary near Kooskia.

[1] Values for seasons having the same letter are signifiiantly different from each other (P < 0.05).

Seasonal Diets : Entire studv area - Significant seasonal differences in proportions of prey items ingested by otters were detected when considering scats sampled over the entire study area (Table 24). Spring diets differed from all other seasons (Chi-square $_{summer}$ = 49.2, 6 df, P <O.OOl; Chi-square $_{fall}$ = 62.1, 6 df, P < 0.001; Chi-square $_{winter}$ = 42.3, 6 df, P < 0.001). Summer diets also differed from fall and winter diets (Chi-square $_{fall}$ = 35.3, 6 df, P < 0.001; Chi-square $_{winter}$ = 42.5, 6 df, P < 0.001). Fall and winter diets were the only two seasons for which diets were similar.

Spring diets differ from all other diets because salmonids were consumed almost twice as frequently as in any other season, while crayfish were detected 3-5 times less than any other season (Fig. 9). Use of salmonids peaked during spring, comprising 38% of the spring diet. Catostomids were the next most frequent spring prey comprising 29% of the diet. Crayfish comprised < 10% of the spring diet and was surpassed by cottids as the third most frequently used prey for this season.

Summer diets appeared to differ from fall and winter diets because suckers were consumed almost half as frequently during this season as compared to fall and winter. During summer, use of crayfish reached an annual high (35%), while frequencies of both salmonids (21%) and catostomids (20%) dropped from spring frequencies.

Proportions of suckers (fall=38%, winter=37%), crayfish (fall=26%, winter=19%) and salmonids (fall=15%, winter=19%) were similar for fall and winter seasons. During fall, catostomids were used most frequently (38%), followed by crayfish (268), while use of salmonids declined further to an annual low (15%). During winter, catostomids remained the most frequently recorded prey item (38%), while salmonids (19%) and crayfish (19%) were used at equal but *lesser* amounts.

Cottids were used in equal proportions throughout all seasons and comprised around 10% of the diet during each season.

Proportions of crayfish and fish in the diet differed significantly within all seasons (Chi-square = 51.1, 3 df, P < 0.001) (Table 24). Pairwise comparisons indicated that all combinations of seasons differed at P = < 0.05 level of significance. Use of crayfish was highest during summer and gradually decreased through the year to a low in winter.

Seasonal Diets: Within River Sections - Seasonal differences in diets were detected within the lower (Chi-square = 57.9, 18 df, P < 0.001) and upper (Chi-square = 74.0, 18 df, P < 0.001) river sections (Table 24). Not enough data was available to determine seasonal differences in diets of otters from the Potlatch River. In both lower and upper river sections, the three most common prey items were catostomids, salmonids, and crayfish.

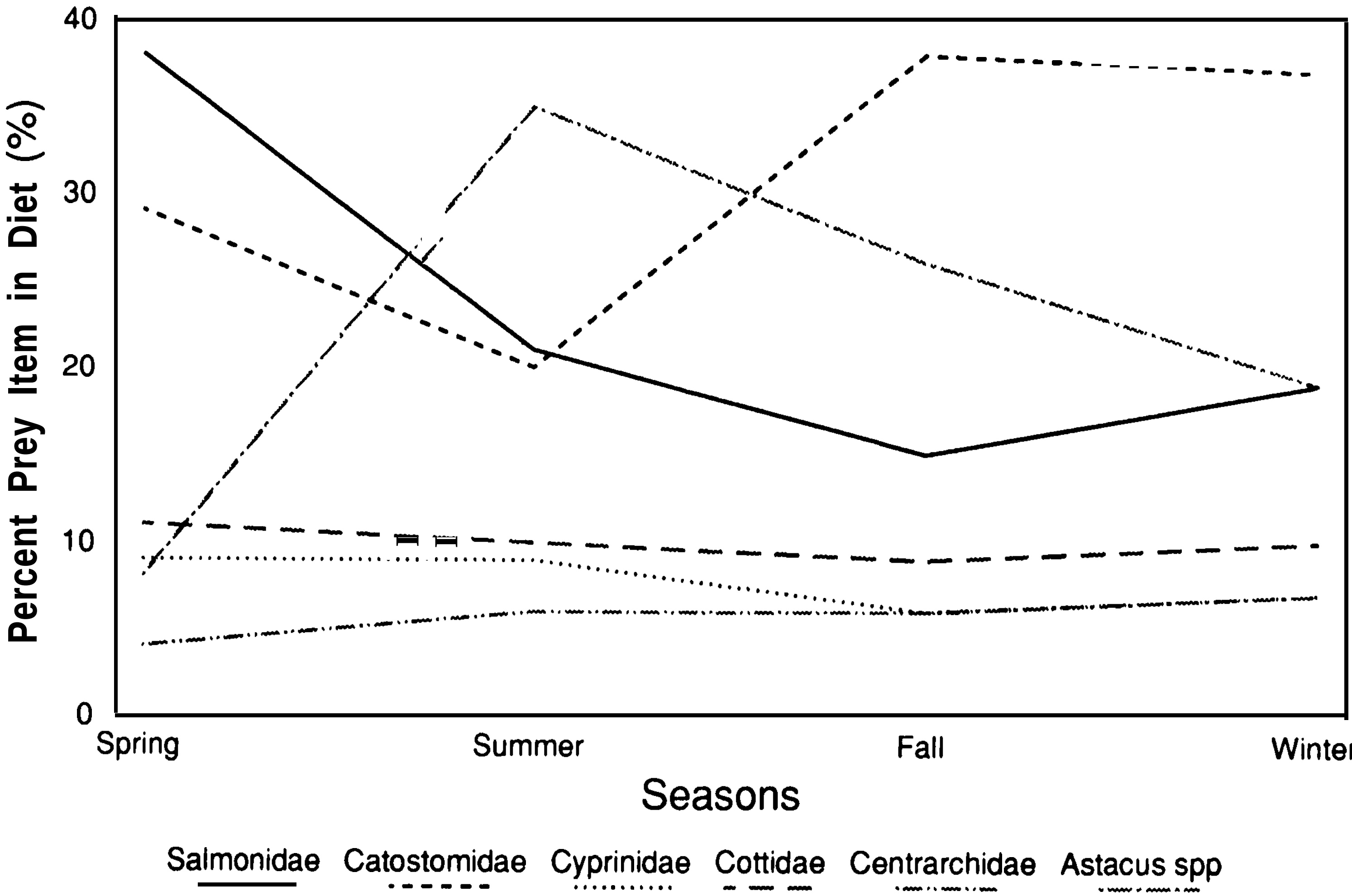


Fig. 9. Seasonal percentages o' identified prey items found in otter scat collected during monthly latrine site surveys in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-1992.

Both sections had similar seasonal patterns. Suckers were more frequent in the diet during fall and winter for both sections, and use of crayfish was lowest during spring and highest during summer and fall. In addition, salmonid consumption was highest during spring. Salmonid consumption by otters in the upper section dropped unexplainably to 7% in the fall, and was comprised solely of mountain whitefish. Use of Salmonids for the other seasons ranged between 18-29%.

DISCUSSION

Fish were the most frequent prey of otters in the Clearwater River, comprising almost 80% of otter diets. Diets of otters foraging in the lower and upper sections of the Clearwater River were similar but differed greatly from diets of otters foraging in the Potlatch River.

Although crayfish contributed a larger proportion to the diet throughout all seasons in the lower section and catostomids tended to be used in greater frequency during most of the year in the upper river section, diet composition and seasonal patterns were generally similar for both of these sections. Catostomids, salmonids, and crayfish comprised the three most common prey items for otters foraging in these two sections. During spring, salmonids were used most frequently by otters, while consumption of crayfish was at its minimum. During summer otters maximized foraging on crayfish, and during fall and winter otters foraged most heavily on suckers. Use of crayfish varied through all seasons, comprising over 30% of otter diets in summer and gradually diminishing through the year to a low (8%) in spring.

Diet composition of otters foraging in the Potlatch river differed from both the lower and upper sections. Otters foraging in this section consumed crayfish, cyprinids, and centrarchids most frequently. Salmonids and catostomids each comprised less than 10% of diets of otters foraging in this section.

Although cottids made up only 10% of the otters' overall diet, their use remained consistent across all sections throughout the year, indicating they were well distributed and available for otters year-round throughout the study area.

Diets of otters in the Clearwater River were similar to results of other studies, which reported fish as the most frequently used prey item and use of crayfish also common (Lagler and Ostenson 1942, Greer 1955, Sheldon and Toll 1964, Toweill 1974, Melquist and Hornocker 1983, Stenson et al. 1984, Mack 1985, Anderson and Woolf 1987, Route and Peterson 1988, McDonald 1989). Otters are opportunistic, feeding on prey in proportion to their realized availability (relative abundance modified by vulnerability to otter predation) (Mack 1985). We inferred that diets of otters in the Clearwater are a reflection of the relative abundance and vulnerability of prey items during different seasons and within different sections of the study area. Crayfish are likely more abundant in the lower Clearwater River and tributaries and account for a larger proportion of diets of otters foraging in those areas. Additionally, the vulnerability of crayfish must change seasonally, with crayfish being most vulnerable to otter predation during summer and least during spring.

MITIGATION RECOMMENDATIONS

The mitigation proposal outlined by Mueleman et al. (1989), and included in the Wildlife Mitigation Agreement for Dworshak Dam (Bonneville Power Administration 1992), to compensate for the majority of river otter habitat losses incurred at Dworshak Dam included measures to protect and enhance riparian habitats along the Clearwater River. Implementation objectives included: 1) protect and enhance 21 miles of riparian habitats along the Clearwater River from the mouth of Fish Creek downstream to the slackwater of Lower Granite Dam and 2) protect and enhance 133 acres of riparian habitats on islands or side channel sloughs along the lower Clearwater River downstream from the dam site. The Nez Perce Tribe will develop a mitigation implementation plan to meet these mitigation objectives for riparian habitats in the Clearwater River corridor.

This chapter provides recommendations to help guide the development of the mitigation implementation plan for riparian habitats in the Clearwater River corridor. Based on the findings of this study, we identify and prioritize sections of the Clearwater River within the study area, that if protected or enhanced would provide optimal benefit to otters. We also outline habitat improvement alternatives which could by used to enhance otter habitats.

RIPARIAN HABITATS IN THE CLEARWATER RIVER

Optimal otter habitat has been described as slow moving, productive rivers meandering through wide flood plains supporting well developed riparian zones. Such rivers usually have braided channel systems with many side channel and backwater sloughs. Optimal shoreline habitats are described as undercut organic banks supporting dense vegetation. River otter habitat in the Clearwater River does not fit the picture of optimal habitat described above. The Clearwater River is predominantly a single channel system with rocky shorelines supporting marginal riparian vegetation. This study highlighted the degree to which the Clearwater River has been channelized. Over 40% of the shoreline in the upper river section have been riprapped. Likewise, over 30% of the shorelines have been riprapped in the lower river section which has either completely or partially dewatered four of the five backwater channels found in this section. Shoreline habitats along the mainstem Clearwater River are characterized by long reaches of non-habitat punctuated by isolated pockets of otter habitat. These "insular habitats" are vital in maintaining otter numbers in the study area as otters key in on these areas for foraging, denning, grooming, and pup rearing.

Our findings also revealed the adaptable nature of river otters. High trap success, frequent otter sightings in the study area, and abundant otter sign found throughout the study area suggested the Clearwater River corridor supports a healthy sub-population of otters, despite the amount of disturbance to the river. We attribute this to the adaptability of river otters in exploiting disturbed shorelines and the productivity of the Clearwater River to supply ample forage for otters.

IMPORTANT RIVER OTTER HABITATS IN THE CLEARWATER RIVER

Mainstem Habitats

Insular habitats along mainstem shorelines of the Clearwater River can be classified as either "fragmented rock" or "riparian". Otters in the Clearwater River chose den sites based on the suitability of bank substrates, more than any other habitat variable measured during this study. The availability of suitable bank substrates may be an important habitat consideration in limiting the number of otter den site in the study area. The two suitable bank substrates used for denning by otters in the study area were rock and organic. Although most (88.4%) shorelines were rocky, only approximately 16% of the study area contained suitable rock substrates for otter den sites. Rocky shorelines used for den sites by otters in the study area included fragmented boulder sized rock piles containing large interstitial spaces. Suitable sites were found most commonly along riprapped shorelines and less frequently along natural rock and boulder shorelines. Over 40% of all documented otter dens were located in riprapped shorelines. A typical fragmented rock insular habitat site occurred where the Camas Prairie Railroad bed was dynamited through a rocky ridge that extended down to the river. The ridge was reduced to large boulder which were dumped over the embankment into the river. These large piles of loosely stacked boulders projected into the river causing an eddy to form on the downstream side of the projection. Slower moving water in the eddy deposited sediment to formed sandy beaches. This also created habitat for otters: rock cavities provided den sites, sandy beaches provided grooming sites, and eddies provided foraging sites.

Although sand and organic substrates only accounted for 5.1% of the available substrates in the study area, otters preferred these substrates for den sites. Riparian insular habitats occur in small isolated pockets throughout the study area. These sites are typically situated along concave shorelines where upstream shoreline projections cause sediment deposition and eventual organic substrate formation. These sites typically support dense riparian vegetation and receive frequent use by otters as grooming, defecating, and denning sites.

Tributary Habitats

Although tributaries in the study area do not support what would be considered optimal otter habitat, large tributaries did receive regular use by otters in the study area. Large tributaries are important habitats for otters in providing year-round habitat, movement corridors for maintaining interchange between other sub-populations in the drainage, and important natal den and pup rearing habitats. Female otters tend to locate natal dens in secluded areas away from main bodies of water and raise their pups in slower moving side channel or backwater sloughs. Because the mainstem Clearwater River has very little isolated side channel habitat, tributary streams may support the most important natal den and pup rearing habitats in the study area. Although small tributaries in the study area received very little year-round use by otters, they may be used for natal den areas by female otters during the breeding season.

The best example of a riparian insular habitat in the study area is found in the lower Potlatch River, a large tributary to the Clearwater River. The flood plain is relatively undeveloped and still supports a well developed riparian zone. The flood plain is broad in places containing many side channels and backwater sloughs. Substrates are organic, supporting dense riparian vegetation. The Potlatch River received the most frequent use by instrumented otters of any other tributary stream. The Potlatch River also supports important natal den and pup rearing habitat. One instrumented female otter established a natal den in an isolated tributary to the Potlatch which she used for three consecutive years during the study. Once the pups were old enough to leave the den, the female moved them to the main Potlatch River where the family group predominantly used side channel and backwater slough habitats. Although the Potlatch River supports a marginal fishery and no fishery existed in the natal den tributary, both waterways supported dense populations of crayfish which provided a readily available source of protein for the adult and growing young.

MITIGATION RECOMMENDATIONS

Our recommended priority for selecting waterways for mitigation measures is tributary streams, side channel and backwater sloughs, mainstem river, and island habitats. Priorities are based on ecological values to river otters. Other considerations such as availability for purchase, purchase price, or level of risk of development will also influence the selection of the mitigation measures included in the mitigation plan.

Tributary Habitats

1) Target large rather than small tributaries in the Clearwater drainage for mitigation efforts.

2) Direct mitigation efforts toward protecting and enhancing the lower end of tributary drainage, preferably including their confluence with the Clearwater River.

3) Mitigation lands should include, at a minimum, 1 km of shoreline containing contiguous riparian habitats.

4) Select tributaries that currently support or have the potential to support good otter habitat including well developed riparian vegetation, wide riparian zone, organic or large rocky substrates for denning sites, adequate forage, adequate stream depths and flows, etc...

4) Prioritize selection of tributaries for mitigation measures first based on quality of current and/or potential otter habitat and secondly on the level of risk of being developed or degraded. Priority should be given to protecting tributaries that currently support good otter habitat and have a high risk of being developed or otherwise degraded.

Suggested priority:

a. Potlatch River
b. South Fork Clearwater River
c. Clear Creek
d. Lo1o Creek
e. Lapwai Creek
f. Cottonwood Creek

Enhancement alternatives:

a. Create impoundments to increase channel depth and shoreline habitats, and to increase habitats for river otter prey species.

b. Create small islands within impoundments to increase shoreline and side channels slough habitats.

c. Create rock or log instream obstructions to encourage pooling and provide denning sites.

d. Restore riparian vegetation through grass, shrub, and tree plantings.

Side Channel Slough Habitats

1) Enhance existing degraded side channel sloughs along mainstem habitats of the lower river section.

2) Because restoring these habitats along the Clearwater River will entail considerable expense, we recommend that feasibility studies, cost estimates, and cost/benefit analysis be conducted for all potential sites.

3) Protect existing side channel sloughs.

Potential side channel slough sites:
a. Turkey Island (restoration)
b. P&M/Percy's slough (restoration)
c. Heart of the Monster slough (enhancement)
c. Cherry Lane (protection)

Enhancement alternatives:
a. Productive enhancement alternatives will depend on the site under consideration. Potential alternative should be reviewed and analyzed in a feasibility study conducted for each site.

b. Restoration projects should emphasize maintaining year-round flows, maximizing shoreline with in the project area, maximizing pond and slough habitats, and restoring riparian vegetation.

c. Restoration projects should include either rock or log structures suitable for denning sites.

Mainstem Habitats

1) Target sections adjacent to confluences with large tributaries preferable ones targeted for mitigation.

2) Select river sections supporting important otter habitat including boulder outcrops, large riprap substrates, well developed riparian vegetation with organic bank substrates, and side channel sloughs.

3) Prioritize selection of river sections first based on quality of current and/or potential otter habitat and secondly on the level of risk of being developed or degraded. Priority should be given to protecting river sections currently supporting good otter habitat and have a high risk of being developed or otherwise degraded.

Enhancement alternatives:

a. Because of its single channel and rocky shoreline nature, few alternatives exist along mainstem habitats of the Clearwater River.

b. Restore flows, construct denning structures, and enhance channel morphology in side channel sloughs habitats.

c. Construct shoreline denning structures that project into river channel in areas lacking suitable denning habitats.

Island Habitats

1) Select islands which currently receive use by otters and/or beaver.

2) Prioritize islands containing organic substrates, well developed riparian vegetation, and side channel habitats.

3) Avoid selecting gravel bar islands for protection or enhancement measures.

Suggested Island Habitats

a. Fir Island
b. Hog Islands

Enhancement alternatives:

a. Few enhancement alternatives exist for island habitats.

b. Alternatives should emphasize developing side channel slough habitats, constructing denning structures, and improving riparian vegetation.

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Appendix

A

Mean stadard morpbomethc measuremeds
of river otters captured in the Clearwater River, Idaho 1991-92

Appendix A-l. Mean standard measurements (nun) of juvenile, yeading and adult female river otters captured in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Measurement/Age Class	n	X	SD	min.	max.
Total Length					
Juvenile	1	1110.0			
Yearling	2	1192.5	24.7	1175.0	1210.0
Adult	1	1250.0			
Tail Length					
Juvenile	1	390.0			
Year1ing	2	435.0	21.2	420.0	450.0
Adult	1	460.0			
Head Length					
Juvenile	1	150.0			
Yearling	2	145.0	7.1	140.0	150.0
Adult	1	160.0			
Hind Foot Length					
Juvenile	1	130.0			
Yearling	2	125.0	21.2	110.0	140.0
Adult	1	140.0			
Tail Circumference					
Juvenile	1	165.0			
Yearling	2	182.5	3.5	180.0	185.0
Adult	1	190.0			
Neck Circumf ***erence***					
Juvenile	1	280.0			
Yearling	2	315.0	7.1	310.0	320.0
Adult	1	310.0			
Chest Circumference					
Juvenile	1	375.0			
Yearling	2	415.0	7.1	410.0	420.0
Adult	1	395.0			
Head Width					
Juvenile	1	100-0			
Yearling	2	122.5	10.6	115.0	130.0
Adult	1	120.0			
Hind Foot Width					
Juvenile	1	95.0			
Yearling	2	92.5	3.5	90.0	95.0
Adult	1	95.0			
Uro-Anal Distance					
Juvenile	1	25.0			
Yearling	2	30.0	0.0	30.0	30.0
Adult	1	25.0			

Appendix A-2. **Mean standard measurements (mm) of juvenile, yearling, and adult male river otters captured in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.**

Measurement/Age Class	n	$\bar{x}$	SD	min.	max.
Total Length					
Juvenile	2	1082.5	46.0	1050.0	1115.0
Yearling	2	1197.5	10.6	1190.0	1205.0
Adult	4	1228.8	63.3	1140.0	1290.0
Tail Length					
Juvenile	2	387.5	3.5	385.0	390.0
Yearling	2	445.0	21.2	430.0	460.0
Adult	4	447.5	55.2	395.0	500.0
Head Length					
Juvenile	2	147.5	10.6	140.0	155.0
Yearling	2	167.5	3.5	165.0	170.0
Adult	4	152.5	12.6	140.0	170.0
Hind Foot Length					
Juvenile	2	135.0	0.0	135.0	135.0
Yearling	2	123.5	2.1	122.0	125.0
Adult	4	132.5	11.9	115.0	140.0
Tail Circumference					
Juvenile	2	120.0	63.6	75.0	165.0
Yearling	2	185.0	0.0	185.0	185.0
Adult	4	171.3	69.1	70.0	220.0
Neck Circumference					
Juvenile	2	302.5	17.7	290.0	315.0
Yearling	2	211.0	125.9	122.0	300.0
Adult	4	340.0	24.5	320.0	370.0
Chest Circumference					
Juvenile	2	365.0	7.1	360.0	370.0
Yearling	2	281.0	182.4	152.0	410.0
Adult	4	443.8	30.9	410.0	470.0
Head Width					
Juvenile	2	115.0	7.1	110.0	120.0
Yearling	2	125.0	7.1	120.0	130.0
Adult	4	121.3	8.5	110.0	130.0
Hind Foot Width					
Juvenile	2	88.5	2.2	87.0	90.0
Yearling	2	96.0	1.4	95.0	97.0
Adult	4	93.0	8.9	80.0	100.0
Uro-Anal Distance					
Juvenile	2	127.5	3.5	125.0	130.0
Yearling	2	162.5	17.7	150.0	175.0
Adult	4	182.5	45.7	150.0	250.0

APPENDIX

B

Clearwater River Otter Project
Mail survey

Appendix B-l. Mail survey questionnaire

Nez Perce
WILDLIFE MANAGEMENT
PO. Box 365 . LAPWAI. IDAHO 83540-0365 • (208) 843-2253

NEZ PERCE TRIBE
CLEARWATER RIVER OTTER STUDY

As part of the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, the Nez Perce Tribal Wildlife Management department has recently initiated a river otter study in the Clearwater drainage. The project will collect data on otter distribution, habitat use, and food habits: in order to identify otter habitats in need of protection and/or enhancement within the Clearwater drainage.

We would like to solicit your involvement in this program, and develop an ongoing, working, relationship with you. We are currently trying to compile information on past and current otter distribution in the drainage through past harvest information, reported otter sightings, and collected incidental trapping data. We have contacted Idaho Fish and Game Biologists and Conservation Officers, U.S. Forest Service Wildlife and Fisheries Biologists, and members of the Idaho Trappers Association, to help in compiling these data.

We would greatly appreciate your participation in filling out the inclosed questionnaire and returning it to our office as soon as possible. We are also very interested in receiving reports of otter sightings through the course of the study. Any sighting of either otters or their sign may be reported to us at the following number:

OTTERHOTLINE

(208) 843-2253 ext 347

Thank you for your time and consideration.

Sincerely,

Curtis Mack

Curt Mack
Project Biologist

FOREST RESOURCES DEPARTMENT

NEZ PERCE TRIBE
CLEARWATER RIVER OTTER STUDY
MAIL SURVEY

Little or no information has been collected on river otter populations in the Clearwater drainage. This survey, as part of an initial study to synthesize available information, was designed to gather and evaluate the extent of "common knowledge" on river otters in the drainage, not recorded in the written literature. Results of this survey will aid in generating a data base which will provide a better understanding of historic and current distribution of river otters in the Clearwater drainage. The usefulness of such a data base is highly dependent upon a high rate of participation. Please take a few minutes to complete the questionnaire and return it promptly to our office:

Otter Distribution Survey
Nez Perce Tribe
Wildlife Management
P.0. Box 365
Lapwai, ID 83540
(208) 843-2253

****

Name : ______________________________

Title: ______________________________

Agency or organization: ______________________________

Number of years employed with agency or organization: __________

District or area trapped: ______________________________

Address: ______________________________

Phone: ______________________________

Date: ______________________________

	YES	NO
Would you like a copy of the survey results?...........	☐	☐
May we contact you for additional information?..........	cl	cl

****

A) Do you have specific information on river otters in the Clearwater drainage? (first or second hand observations of live animals, trapped otters, and/or otter sign)........ YES ❑ NO ❑

If NO, go on to section B.
If YES, please supply, to the best of your knowledge, the following information for each sighting (use additional paper if needed).

1. a. Date: ___________ b. Date Category: pre 1971 ❑ post 1971

c. Data Source: first hand ❑ second hand ❑ literature ❑ other ❑

d. Data Type: observation ❑ trap ❑ sign ❑ other ❑

e. Location (be as specific as possible. A map or legal description would be helpful: T__ __N, R__ __(E or W?), SEC__ __, __ __1/4, __ __1/4):

2. a. Date: ____________ b. Date Category: pre 1971 ❑ post 1971 ❑

c. Data Source: first hand ❑ second hand ❑ literature ❑ other ❑

d. Data Type: observation ❑ trap ❑ sign ❑ other ❑

e. Location (be as specific as possible. A map or legal description would be helpful: T__ __N, R__ __(E or W?), SEC__ __, __ __1/4, __ __1/4):

	YES	NO
B) Do you have general knowledge of river otters in the Clearwater drainage? (personal communications or written material)................................	☐	☐

If NO, please return the questionnaire, and thank you for your participation.
If YES, please answer the following questions, for tributary and mainstem reaches you are most familiar with, by completing the following table using the coded variable values:

1. Would you classify the otter <u>HABITAT</u> in this reach as good (1), fair (2), poor (3), or no opinion (4)?
2. Are <u>REPORTS</u> or observations of otters frequent (1), infrequent but consistent (2), infrequent and sporadic (3), or no opinion (4)?
3. Are most report <u>SOURCES</u> sightings (1), incidental trappings (2), otter sign (3), or no opinion (4)?
4. Do most reports indicate otter <u>USE</u> of mainstem habitats (1), tributary habitats (2), both mainstem and tributary habitats (3), or no opinion (4)?
5. Would you classify <u>OTTERS</u> in this reach as residents (1), transients (2), or no opinion (4)?
6. Would you consider otter <u>STATUS</u> in this reach abundant (1), common (2), uncommon (3), or no opinion (4)?
7. Do otter <u>POPULATIONS</u> appear to be increasing (1), stable (2), decreasing (3), or no opinion (4)?

REACH	HABITAT	REPORTS	SOURCES	USE	OTTERS	STATUS	POPULATIONS
1. ____________________	____	____	____	____	____	____	____
2. ____________________	____	____	____	____	____	____	____
3. ____________________	____	____	____	____	____	____	____
4. ____________________	____	____	____	____	____	____	____
5. ____________________	____	____	____	____	____	____	____
6. ____________________	____	____	____	____	____	____	____

Appendix B-2. Results of the general information section of the Clearwater River Otter Project's mail survey, showing number and distribution of responses received for each question (explanation to each abbreviation given in footnote below).

	Habitat Condition			Otter Reports			Information Sources			Habitat Use				Status			Population Abundance				Trend			
Reach[a]	G	F	P	F	C	S	0	T	S	M	T	M/T	N	R	T	N	A	C	U	N	I	S	D	N
LMCR	2	2	-	1	3	-	3	2	3	1	-	3	-	3	2	1	1	2	l	-	.	4	-	-
UMCR	5	-	-	3	1	1	5	2	2	3	-	2	-	4	3	-	1	3	1	-	2	2	-	-
MFCR	5	-	-	4	1	-	5	3	3	4	-	1	-	5	2	-	1	4	-	-	2	1	-	1
SFCR	3	4	-	2	3	3	5	1	2	5	1	1	1	5	2	-	-	5	2	-	-	5	-	2
Lochsa R.	4	-	-	2	2	-	3	2	2	4	-	-	-	4	-	-	1	3	-	-	2	-	-	1
Selway R.	2	-	-	1	1	-	1	1	2	2	-	-	-	l	-	l	-	1	-	1	-	-	-	1
NFCR	1	1	-	2	-	-	2	-	2	1	1	-	-	2	-	-	-	2	-	-	-	2	-	-
Potlatch R.	3	2	1	4	2	-	3	4	1	4	2	-	-	4	3	-	-	4	2	-	3	3	-	
Lolo Cr.	2	-	-	2	-	-	2	2	2	1	-	1	-	2	-	-	2	-	-	-	2	-	-	.
Orofino Cr.	1	-	-	1	-	-	1	1	1	1	-	-	-	1	1	-	-	1	-	-		1	.	-
Bedrock Cr.	-	1	-	-	1	-	1	1	1	1	-	-	-	1	1	-	-	1	-	-	.	1	-	-
SNKR	1	-	-	1	-	-	1	-	-	1	-	-	-	1	-	-	-	1	-	-	-	-	-	1
Total	29	10	1	23	14	4	32	19	21	28	4	8	1	33	14	2	6	27	6	1	11	19	0	6

[a] LMCR = Lower Mainstem Clearwater River
UMCR = Upper Mainstem Clearwater River
MFCR = Middle Fork Clearwater River
SFCR = South Fork Clearwater River
NFCR = North Fork Clearwater River
SNKR = Snake River

Habitat: G = Good, F = Fair, P = Poor

Reports: F = Frequent, C = Infrequent but consistent, S = Infrequent and sporadic

Sources: O = Observations, T = Incidental trapping, S = Otter Sign

Use: M = Mainstem, T = Tributaries, M/T = Mainstem and Tributaries, N = No Opinion

Status: R = Residents, T = transients, N = No Opinion

Abundance: A = Abundant, C = Common, U = Uncommon, N = No Opinion

Trend: I = Increasing, S = Stable, D = Decreasing,

N = No Opinion

Appendix

C

River otter latrine sites
documented in the Clearwater River, Idaho 1991-192

Appendix C. River otter latrine sites documented in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Name	Code	Reach	Location UTMN	UTME
Upper Hog	01	LMCR[a]	5143550	509000
IDT West	02	LMCR	5145290	516740
IDT Drift	03	LMCR	5145180	516500
Three Island Beach	04	LMCR	5149760	522890
Three Island Log	05	LMCR	5149760	522760
Burnt Pine	06	LMCR	5150080	523230
Cherry Lane Sand Spit	07	LMCR	5151020	524560
Upper Cherry Lane Slough	08	LMCR	5151280	525160
Fir Island	09	LMCR	5151370	525530
Satelliteville	10	LMCR	5152080	529650
Redheart Beach	11	LMCR	5150410	537440
Railroad Cut 1	12	LMCR	5149290	541060
Railroad Cut 2	13	LMCR	5149290	541100
Slide Rock	14	LMCR	5149760	546870
Ahsahka	15	UMCR[b]	5149520	552680
B-B	16	UMCR	5146080	558780
Zan's	17	UMCR	5141600	560860
Zan's Boat Ramp	18	UMCR	5140560	561290
Locust	19	UMCR	5139630	562280
Railroad Tunnel	20	UMCR	5132020	565460
Kooskia Slough Trail	21	UMCR	5110620	577870
Kooskia Slough	22	UMCR	5110570	577910
Mikes Latrine Site	23	UMCR	5131360	565770
Canyon Latrine	24	UMCR	5130800	566160
CWR - 1	25	MFCR[c]	5109280	581420
CWR - 2	26	MFCR	5109280	581380
CWR - 3	27	MFCR	5109240	581220
HTM Slough	28	UMCR	5117500	576310
Nott N. Ham	29	UMCR	5121600	573990
Arrow	30	LMCR	5146100	517300
Dale's Cashway	31	UMCR	5114340	577230
Big Boulder	32	LMCR	5149730	547270
Middle Tripple	33	LMCR	5149720	547120
Lenore	34	LMCR	5150510	534340
Potlatch Bunks 1	35	LMCR	5141270	504320
Potlatch Crib	36	LMCR	5141380	504470
Spalding Bridge 1	37	LMCR	5143160	512300
Mormon Town	38	LMCR	5148480	520970
Pardee	39	UMCR	5126340	568040
Spalding Bridge 2	40	LMCR	5143200	512400
Tramway	41	UMCR	5124040	569930
Carson's	42	LMCR	5144630	516550
BM Old Bridge	43	LMCR	5149030	520760

Appendix C. River otter latrine sites documented in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. (continued)

Name	Code	Reach	Location	
			UTMN	UTME
Little Myrtle	44	LMCR	5147470	518760
Bull Pine	45	UMCR	5149000	555730
Upper Big Myrtle	46	LMCR	5149590	559610
Community Garden	47	UMCR	5145150	559610
Kerby's	48	LMCR	5151280	525320
Harper's Bend	49	LMCR	5148520	541740
Rock Garden	50	UMCR	5116720	575700

[a] LMCR - Lower mainstem Clearwater River from its mouth at Lewiston upstream to its confluence with the North Fork Clearwater River at Orofino.

[b] UMCR - Upper mainstem Clearwater River from its confluence with the North Fork Clear-water River at Orofino upstream to its confluence with the South Fork Clearwater River at Kooskia.

[c] MFCR - Middle Fork Clearwater River from its confluence with the South Fork Clear-water River at Kooskia upstream to its confluence with the Lochsa and Selway Rivers at Lowell.

Appendix

D

Beaver dens documented in the Clearwater River, Idaho 1991-92

Appendix D. Beaver den sites documented during two fall surveys of the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Name	Code	Reach	Status 91	Status 92	Location UTMN	Location UTME
Potlatch Ponds 1	01	LMCR[a]	A[d]	I	5141320	504340
Potlatch Ponds 2	02	LMCR	I[e]	A	5141330	504360
Potlatch Bunk	03	LMCR	A	I	5141130	504750
Seven Chiefs	04	LMCR	A	A	5141410	506560
Upper Hog 1	05	LMCR	I	I	5143400	509460
Upper Hog 2	06	LMCR	A	A	5143520	509000
Big Myrtle	07	LMCR	A	I	5149490	520870
Cottonwood Creek	08	LMCR	A	A	5149520	522490
Burnt Pine	09	LMCR	A	I	5150080	523230
Lower Cherrylane	10	LMCR	A	NP[h]	5150980	524540
Fir Island	11	LMCR	A	A	5151370	525530
Fir Bluff	12	LMCR	A	NL[i]	5151520	527300
Redheart	13	LMCR	A	NP	5150100	537820
Camp T	14	LMCR	A	A	5149700	539940
Peck	15	LMCR	A	A	5149080	542190
D. Jenni	16	UMCR[b]	I	A	5149200	554400
Airport	17	UMCR	A	NL	5148290	556360
Lapwai	18	LMCR	A	A	5143800	513650
Old Highway	19	LMCR	U[f]	A	5143970	515600
Satellite	20	LMCR	U	A	5151970	530230
CWR	21	MFCR[c]	I	U	5109200	581300
Kooskia Gravel Pit	22	UMCR	I	I	5111020	577450
Lonesome Bnk	23	UMCR	A	A	5112210	577930
Bear Beach Stk/Bnk	24	UMCR	A	NL	5112530	577760
HTM Pond Bnk Den	25	UMCR	I	U	5117370	576340
HTM Slough Stk/Bnk	26	UMCR	I	I	5117760	576580
Kamiah Stk/Bnk	27	UMCR	U	A	5117890	576360
The Old Rock	28	UMCR	I	A	5116860	575760
The Rock	29	UMCR	A	A	5117010	575890
Kamiah Frog Pond	30	UMCR	A	A	5120500	575380
Nott N. Ham	31	UMCR	A	A	5121650	573960
Maggie Bend	32	MFCR	A	A	5110950	582780
Mansion Bnk	33	UMCR	I	A	5115700	576230
Above The Rock Stk	34	UMCR	A	A	5116080	575640
Locust	35	UMCR	A	A	5139630	562280
Little Myrtle	36	LMCR	A	A	5146690	518700
Old Mill Site	37	UMCR	U	A	5146230	558600
Orofino Bridge	38	UMCR	U	A	5147280	556950
Ahsahka Fish Hatch.	39	UMCR	U	A	5149480	552960
Cherry Lane Bridge	40	LMCR	ND[g]	A	5150050	524690
Bobo's	41	LMCR	ND	A	5152090	529590
Cove Beach	42	LMCR	ND	A	5150400	537400
Kaylor Tree Farm	43	LMCR	ND	A	5149450	542490

Appendix D. Beaver den sites documented during two fall surveys of the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. (continued)

Name	Code	Reach	Status 91	Status 92	Location UTMN	Location UTME
Mt. Stewart	44	MFCR	ND	A	5109590	579890
Dale's Corner	45	UMCR	ND	A	5113250	578250
Six Mile	46	UMCR	ND	A	5127760	567330
Upper Six	47	UMCR	ND	I	5127250	567490
Five Mile	48	UMCR	ND	A	5133600	564560
Barn Creek	49	UMCR	ND	A	5122800	572090
Ford's Creek	50	UMCR	ND	A	5142670	560530
Myrtle Bridge	51	LMCR	ND	A	5148970	520880
Island 17	52	LMCR	ND	A	5148200	519850
Pump 17	53	LMCR	ND	A	5148080	519380
Middle Hog	54	LMCR	ND	A	5143580	509100
Fish Trap	55	LMCR	ND	A	5140890	505710
Flat Rock	56	LMCR	ND	A	5142130	507300
Agatha	57	LMCR	ND	A	5150350	533200
Upper Satellite	58	LMCR	ND	A	5151560	530600
Bed Rock	59	LMCR	ND	A	5151110	531890

[a] LMCR - Lower mainstem Clearwater River from its mouth at Lewiston upstream to its confluence with the North Fork Clearwater River at Orofino.

[b] UMCR - Upper mainstem Clearwater River from the confluence of the North Fork Clearwater River at Orofino upstream to its confluence with the South Fork Clearwater River at Kooskia.

[c] MFCR - Middle Fork Clearwater River from the confluence of the South Fork River at Kooskia upstream to its confluence with the Lochsa and Selway Rivers at Lowell.

[d] A - Active

[e] I - Inactive

[f] U - Status undetermined

[g] ND - Not documented during this survey

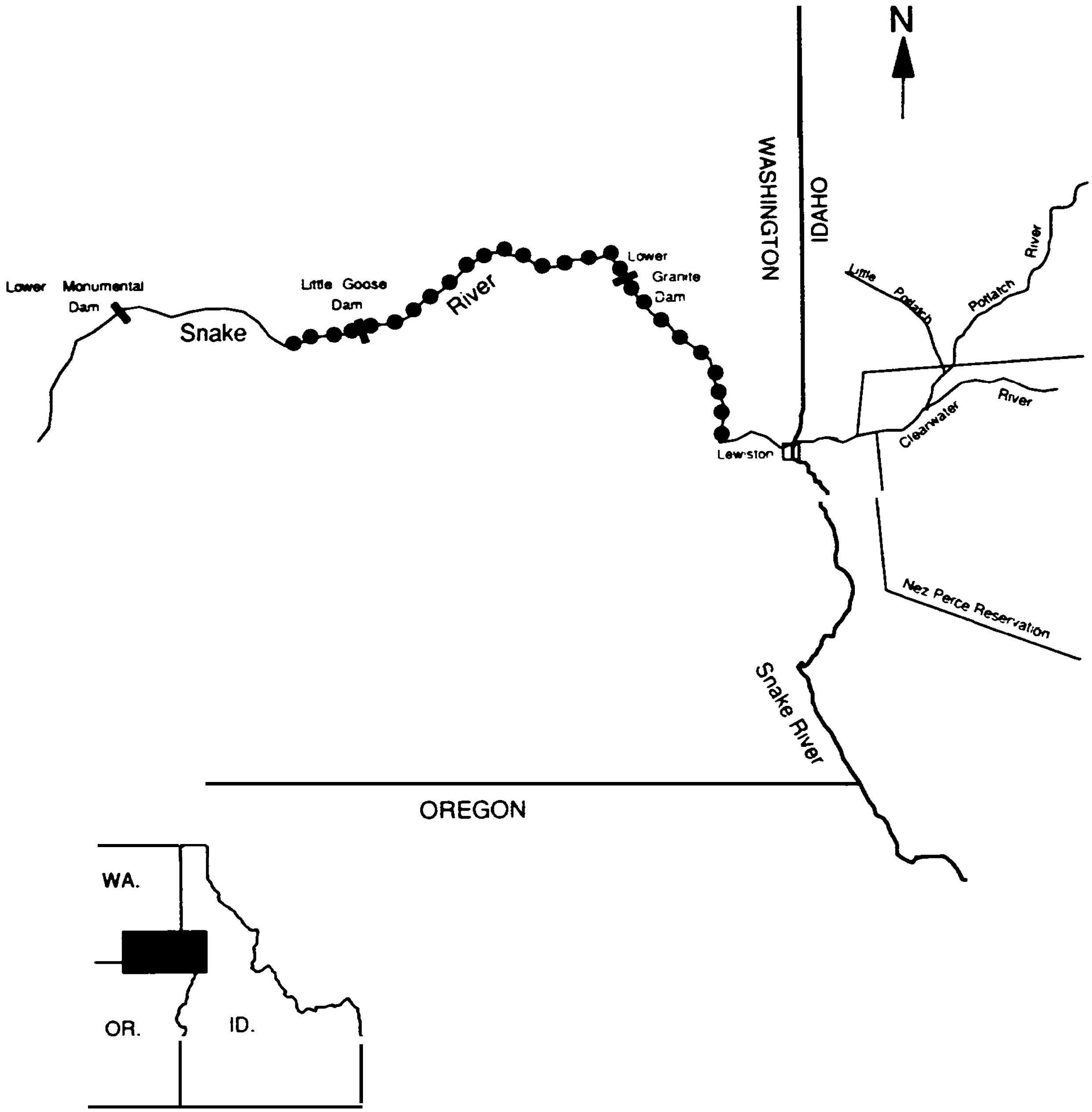
[h] NP - Previously documented colony; colony not present (destroyed/removed) during current survey

[i] NL - Previously documented colony; could not locate during survey; fate unknown

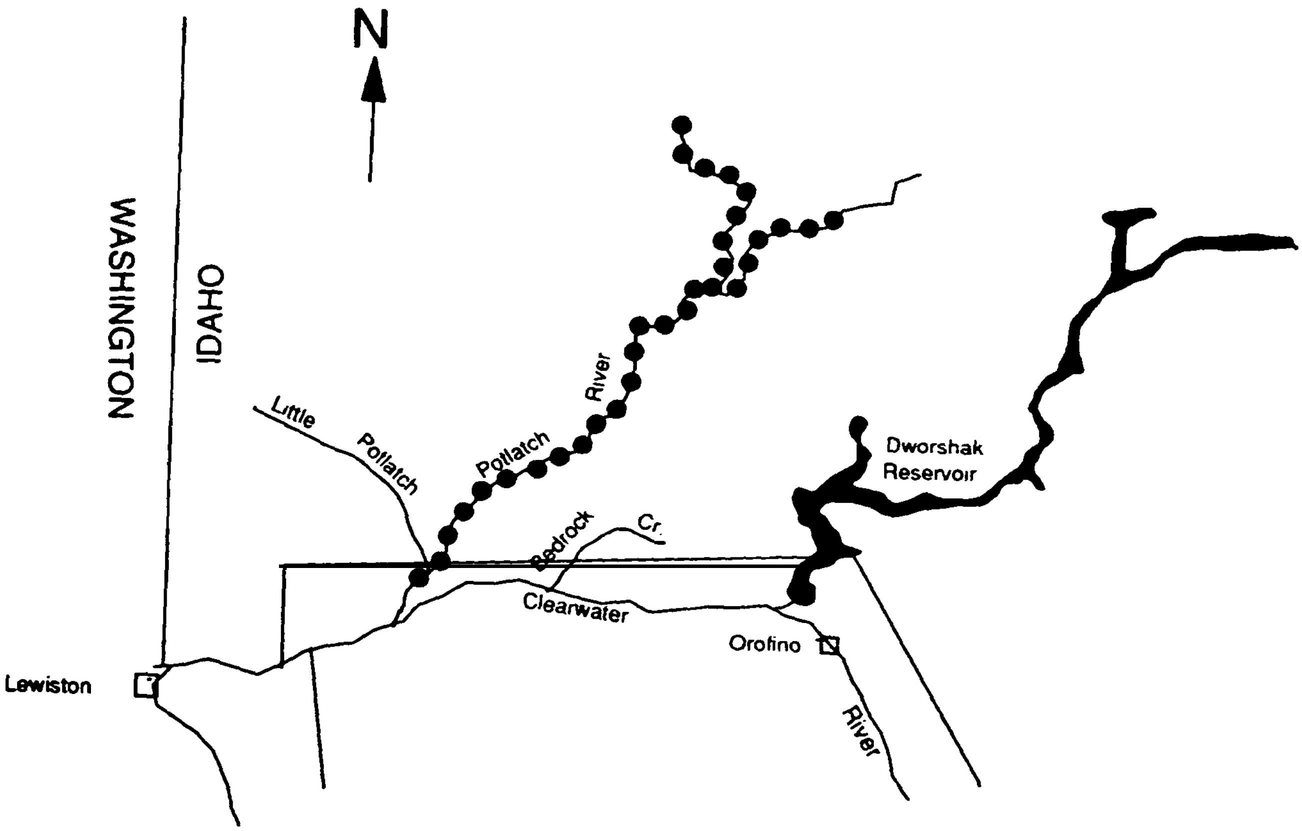
Appendix

E

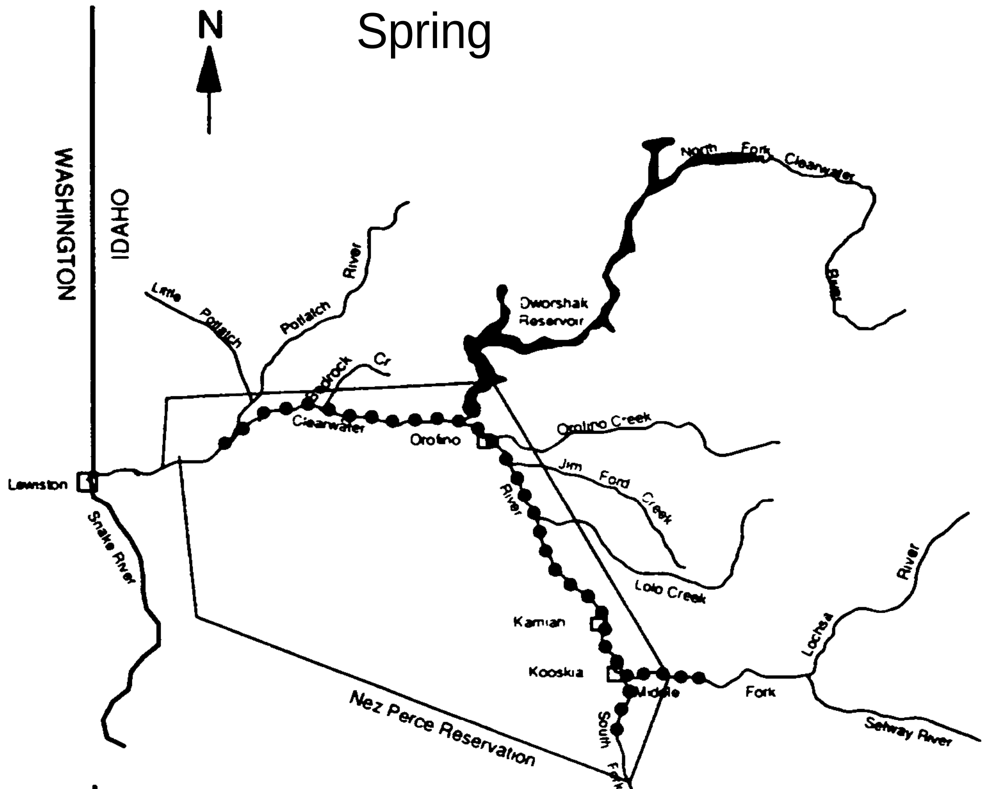
Home ranges of river otters captured in the Clearwater River, Idaho 1992

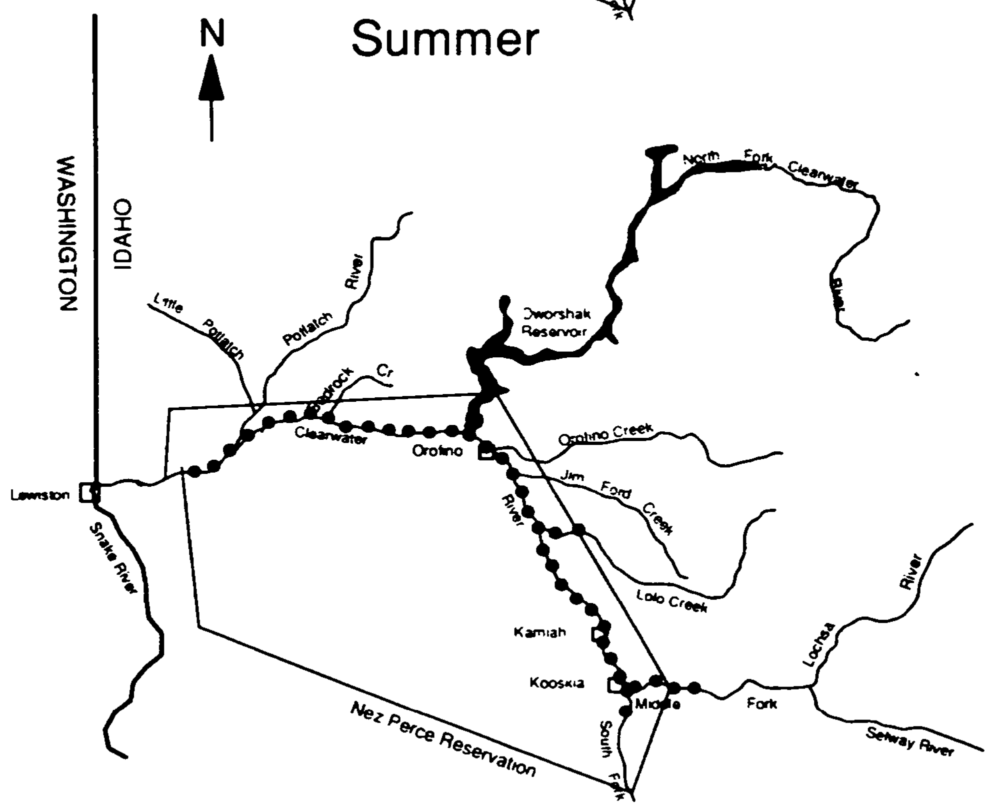


Appendix E-l. Map showing annual home range of adult male river otter Ml, trapped in the Clearwater River, 1992.

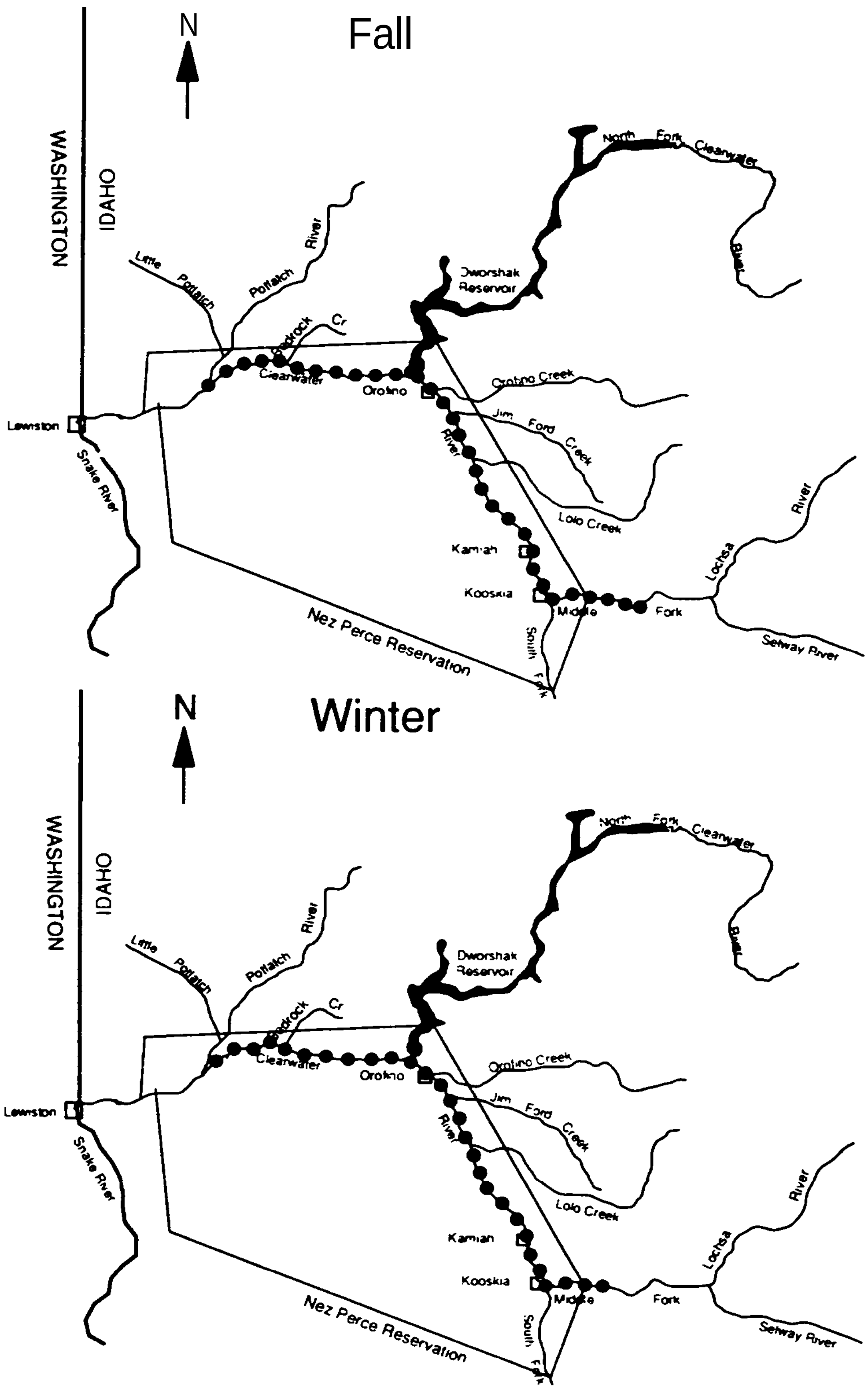


Appendix E-2. Map showing annual home range of adult male river otter M6, trapped in the Clearwater River, 1992.

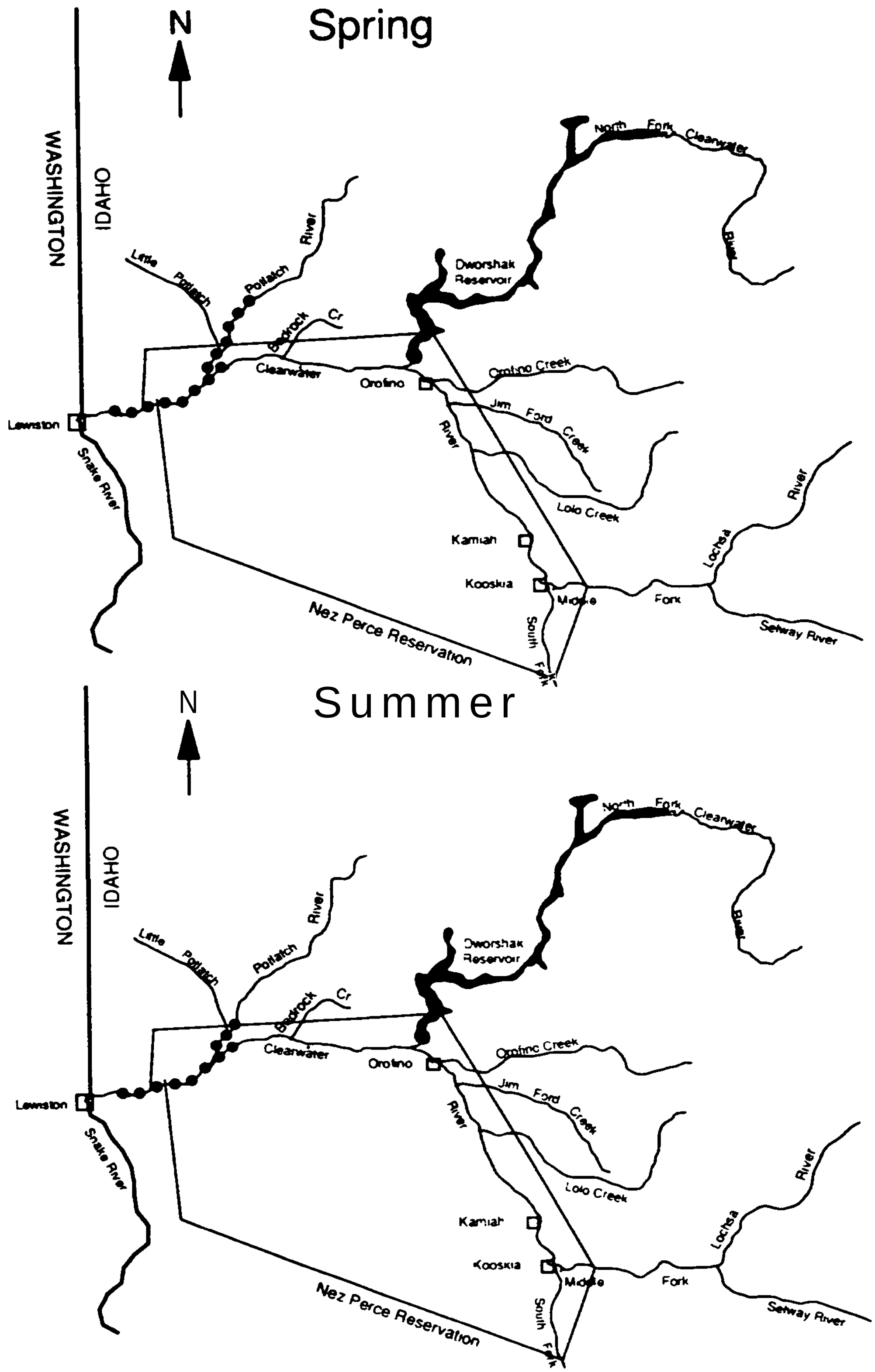




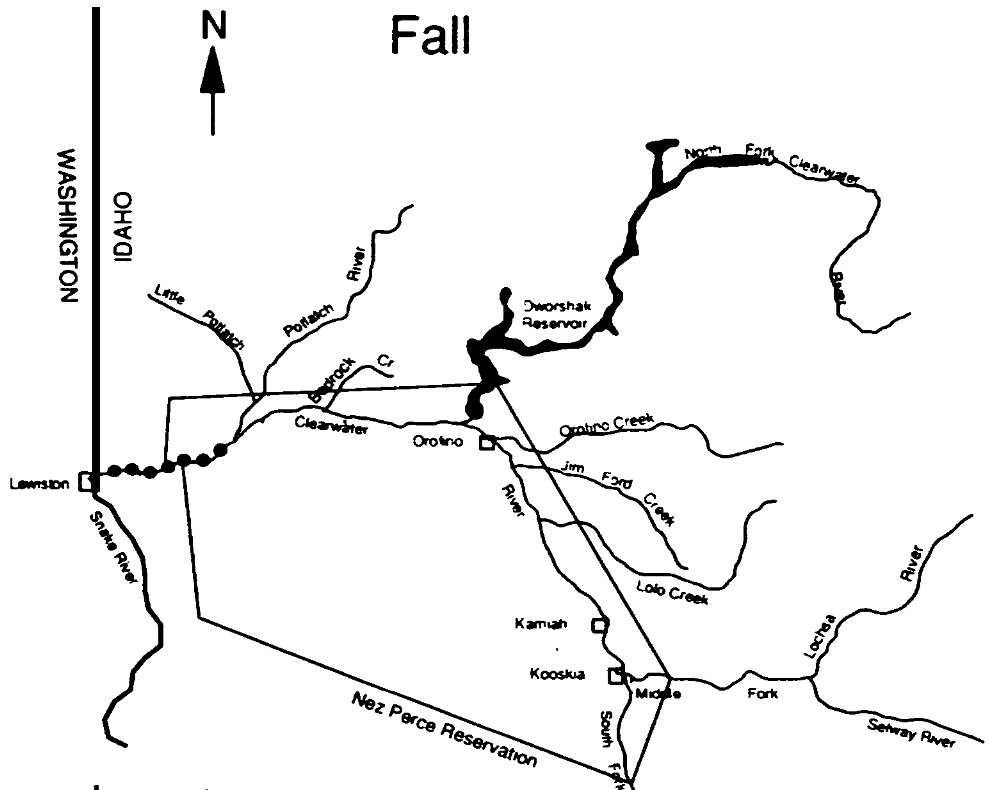
Appendix E-3. Map showing spring and summer home ranges of adult male river otter M2, trapped in the Clearwater River, 1992.

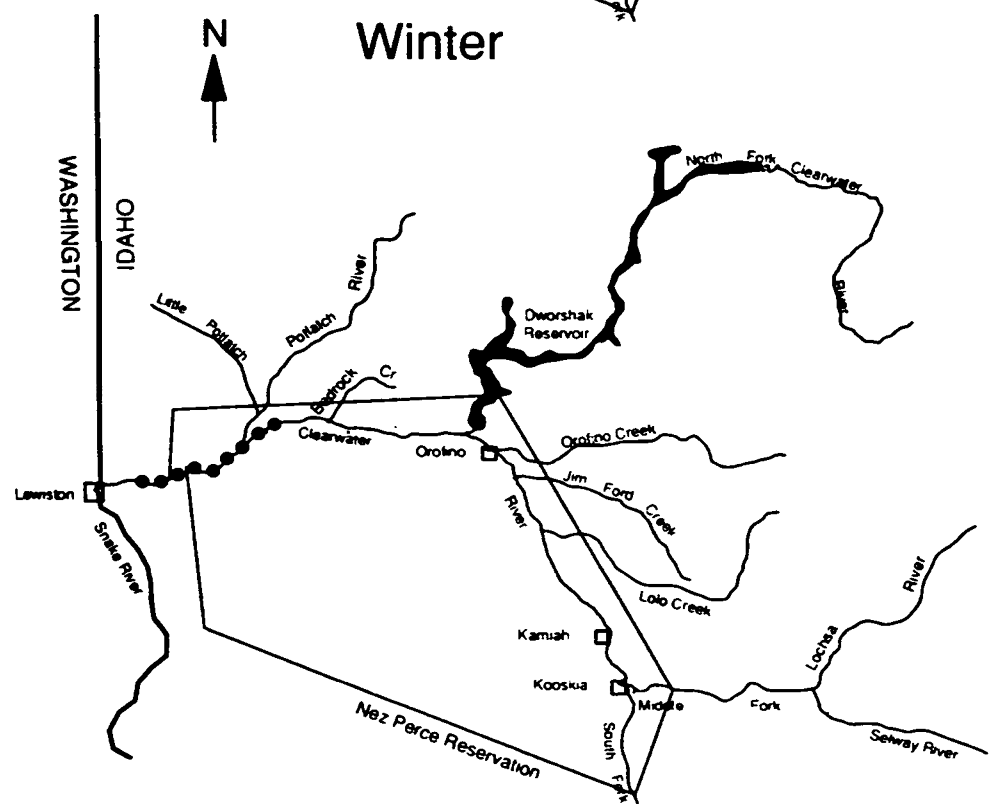


Appendix E-4. Map showing fall and winter home ranges of adult male otter M2, trapped in the Clearwater River, 1992.

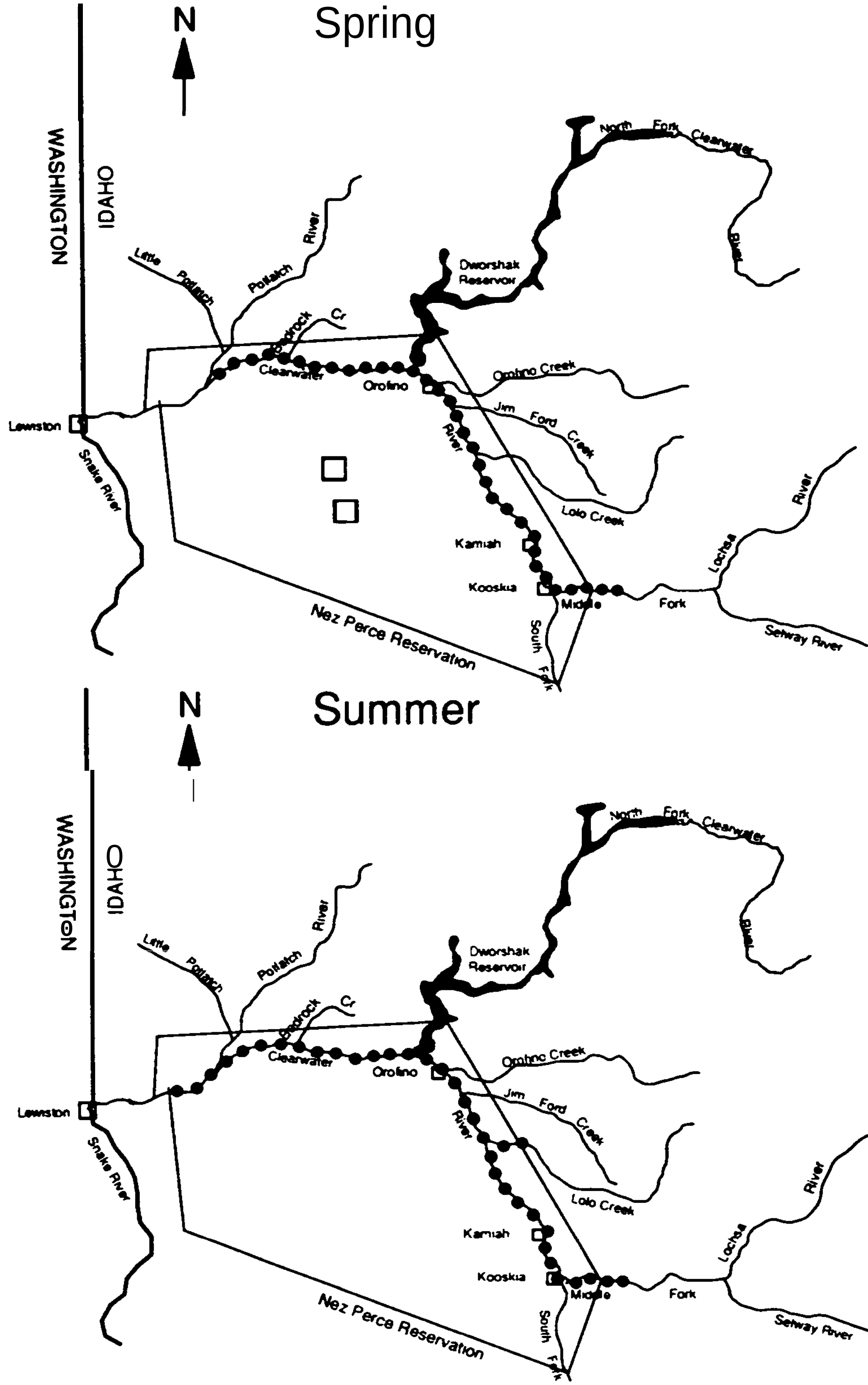


Appendix E-5. Map showing spring and summer home ranges of yearling male otter M3, trapped in the Clearwater River, 1992.

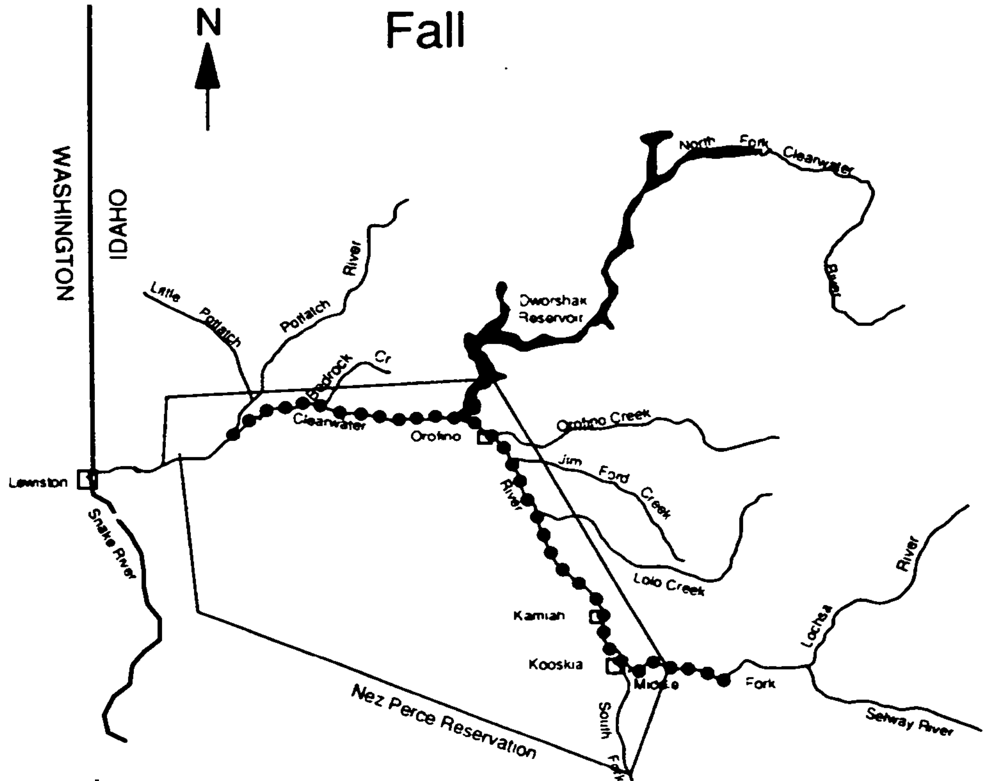


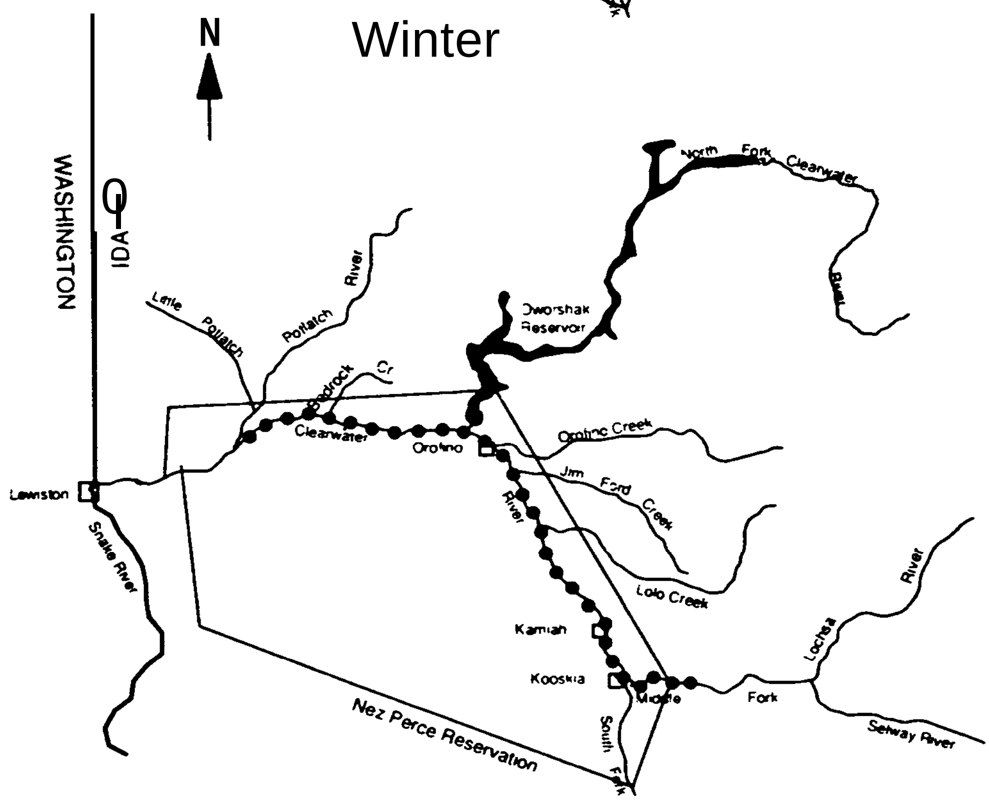


Appendix E-6. Map showing fall and winter home ranges of yearling male otter M3, trapped in the Clearwater River, 1992.

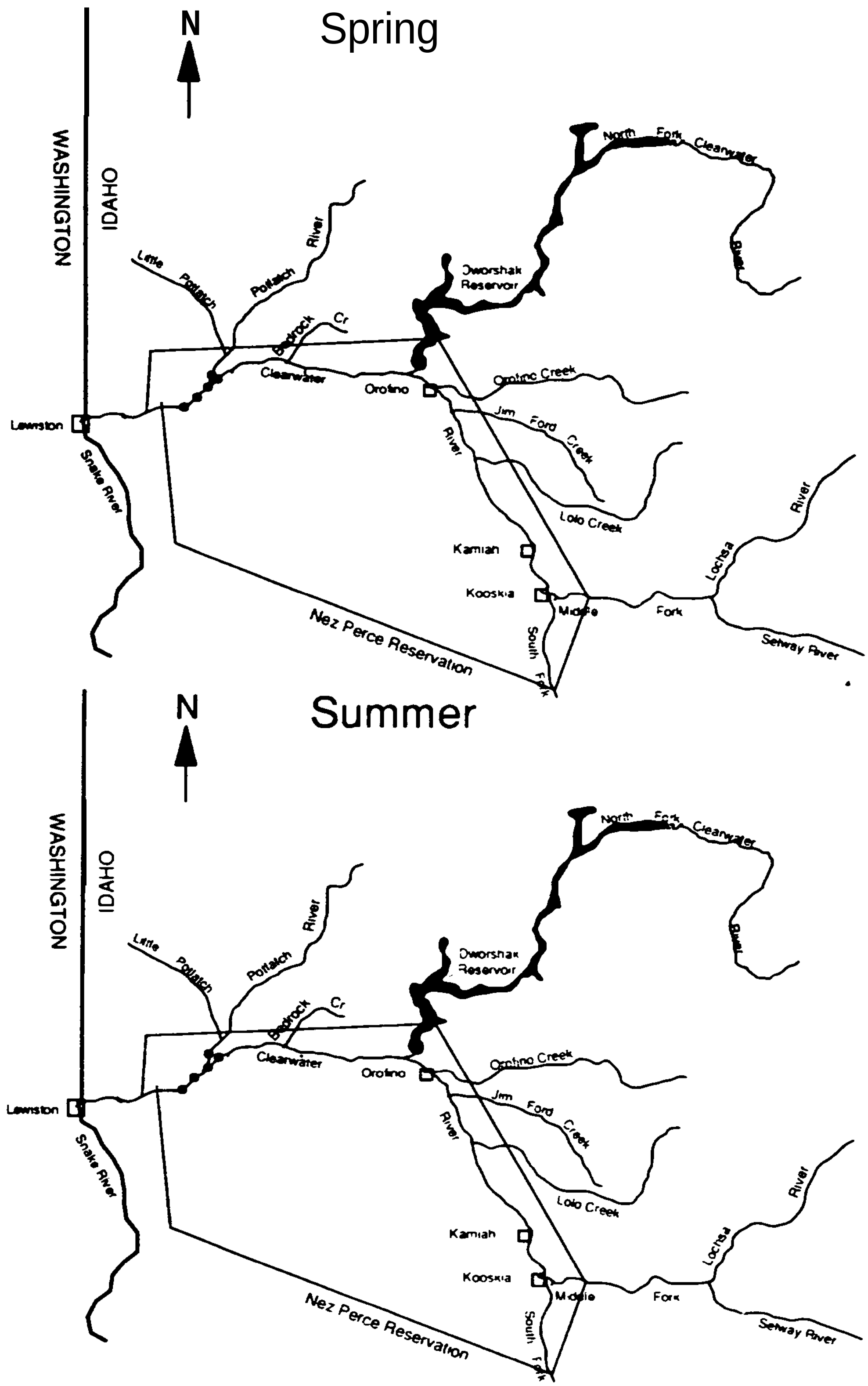


Appendix E-7. Map showing spring and summer home ranges of juvenile male otter M4, trapped in the Clearwater River, 1992.

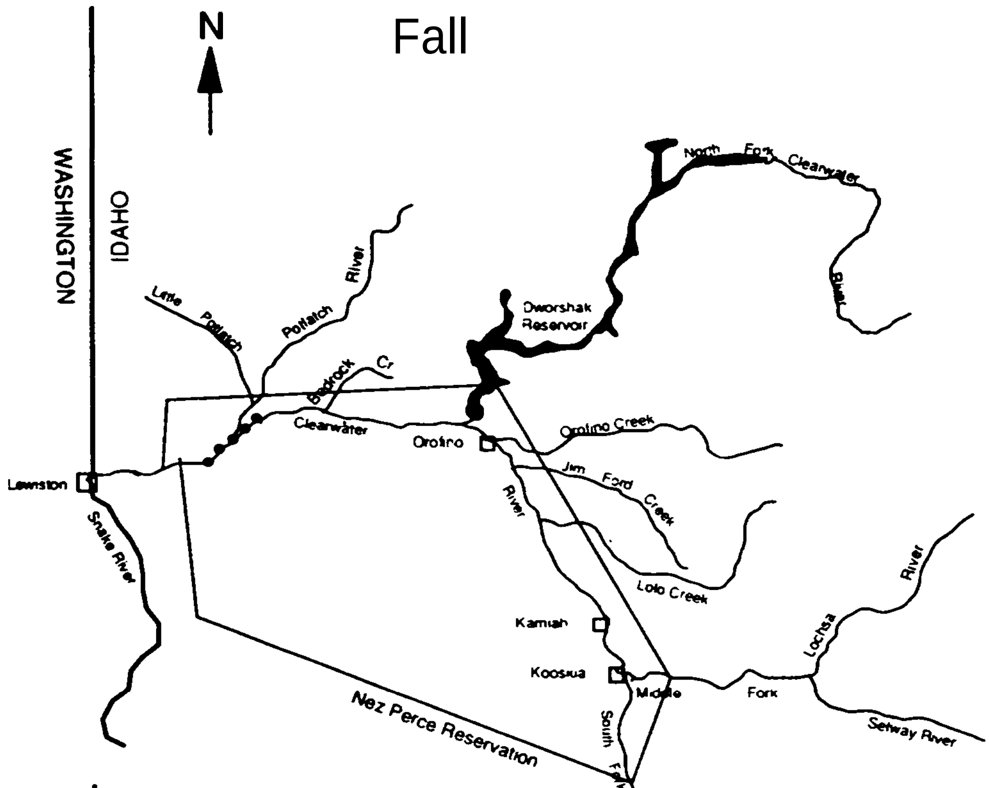


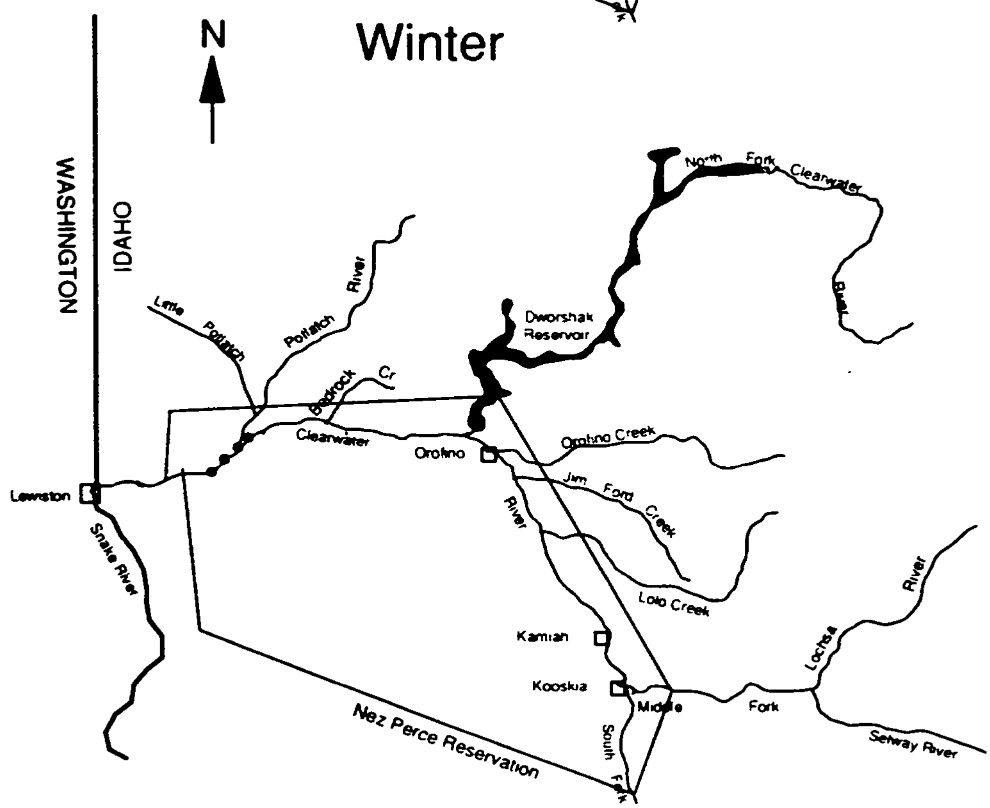


Appendix E-8. Map showing fall and winter home ranges of juvenile male otter M4, trapped in the Clearwater River, 1992.

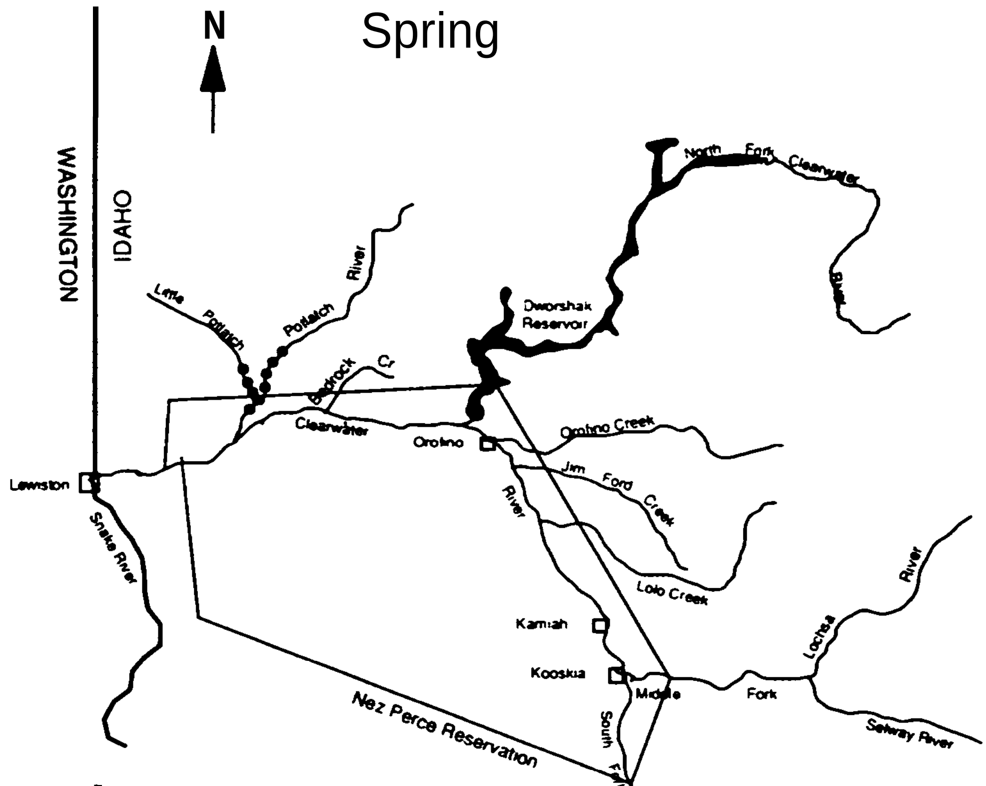


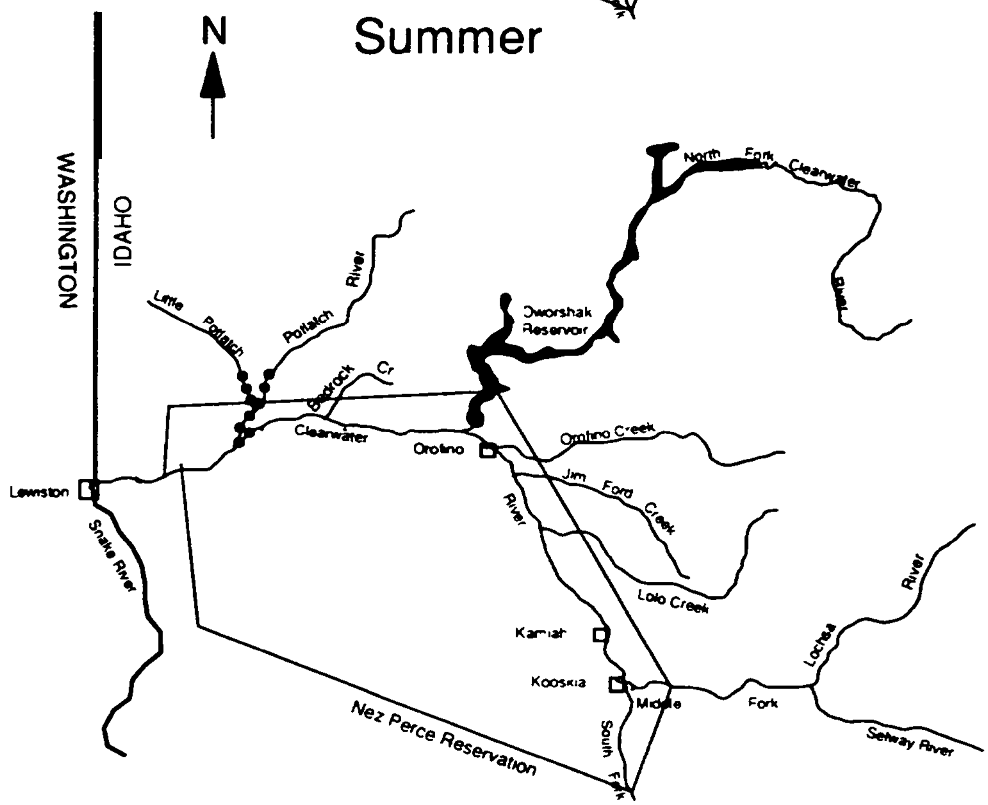
Appendix E-9. Map showing spring and summer home ranges of yearling female otter F8, trapped in the Clearwater River, 1992.



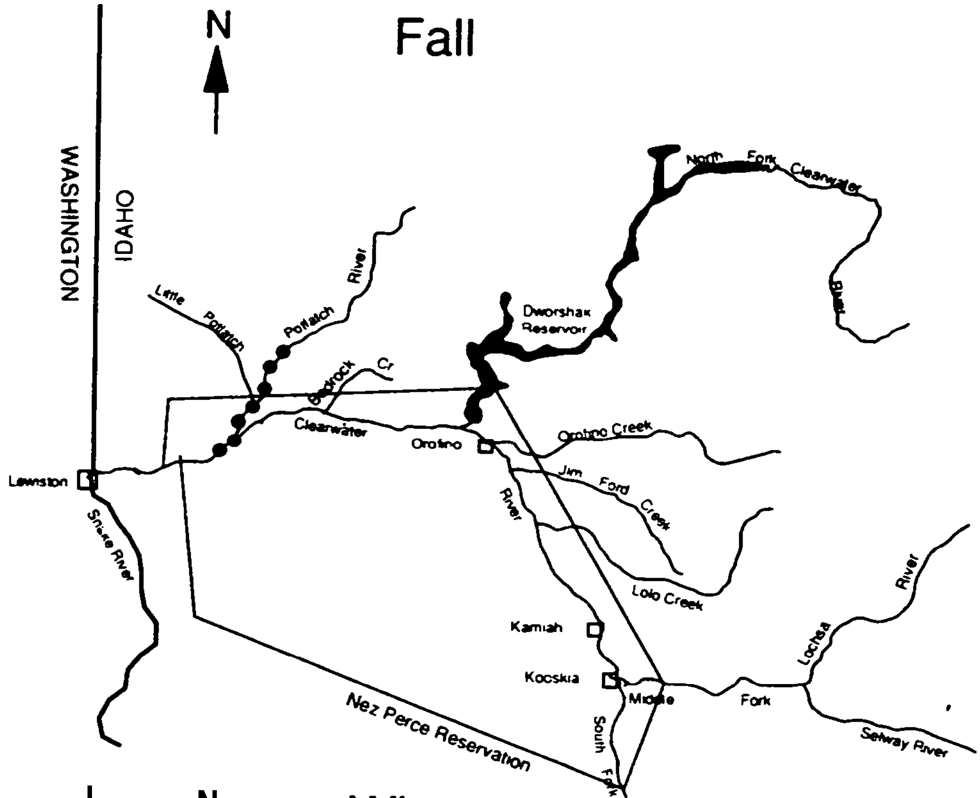


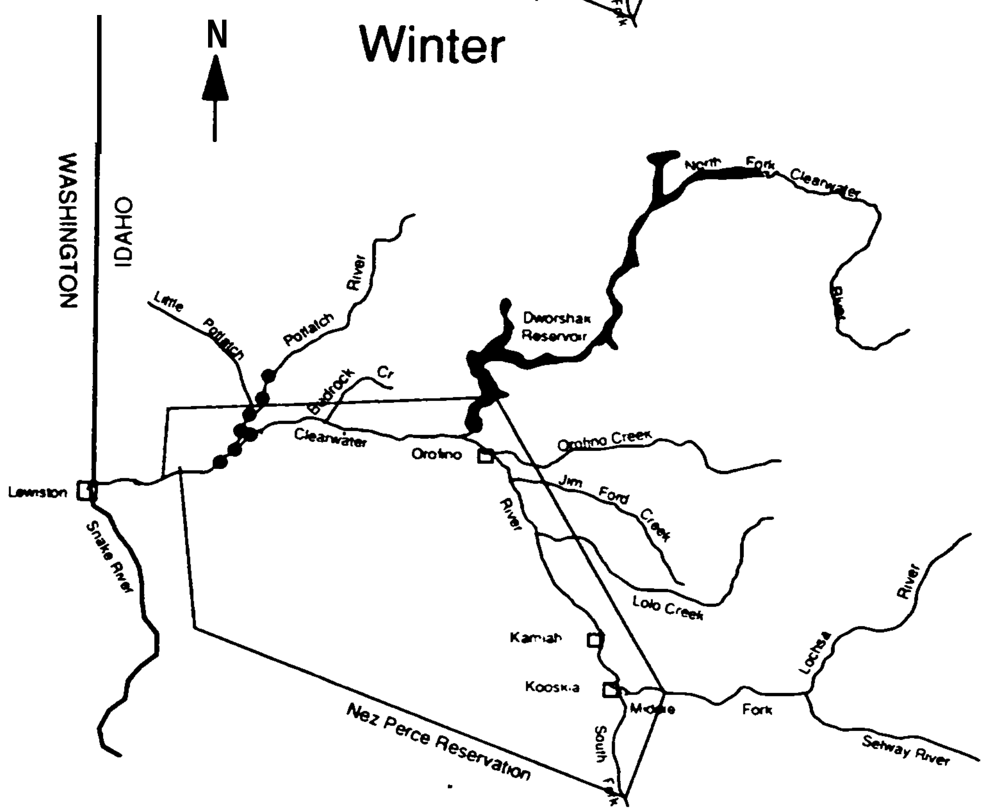
Appendix E-10. Map showing fall and winter home ranges of yearling female otter FS, trapped in the Clearwater River, 1992.



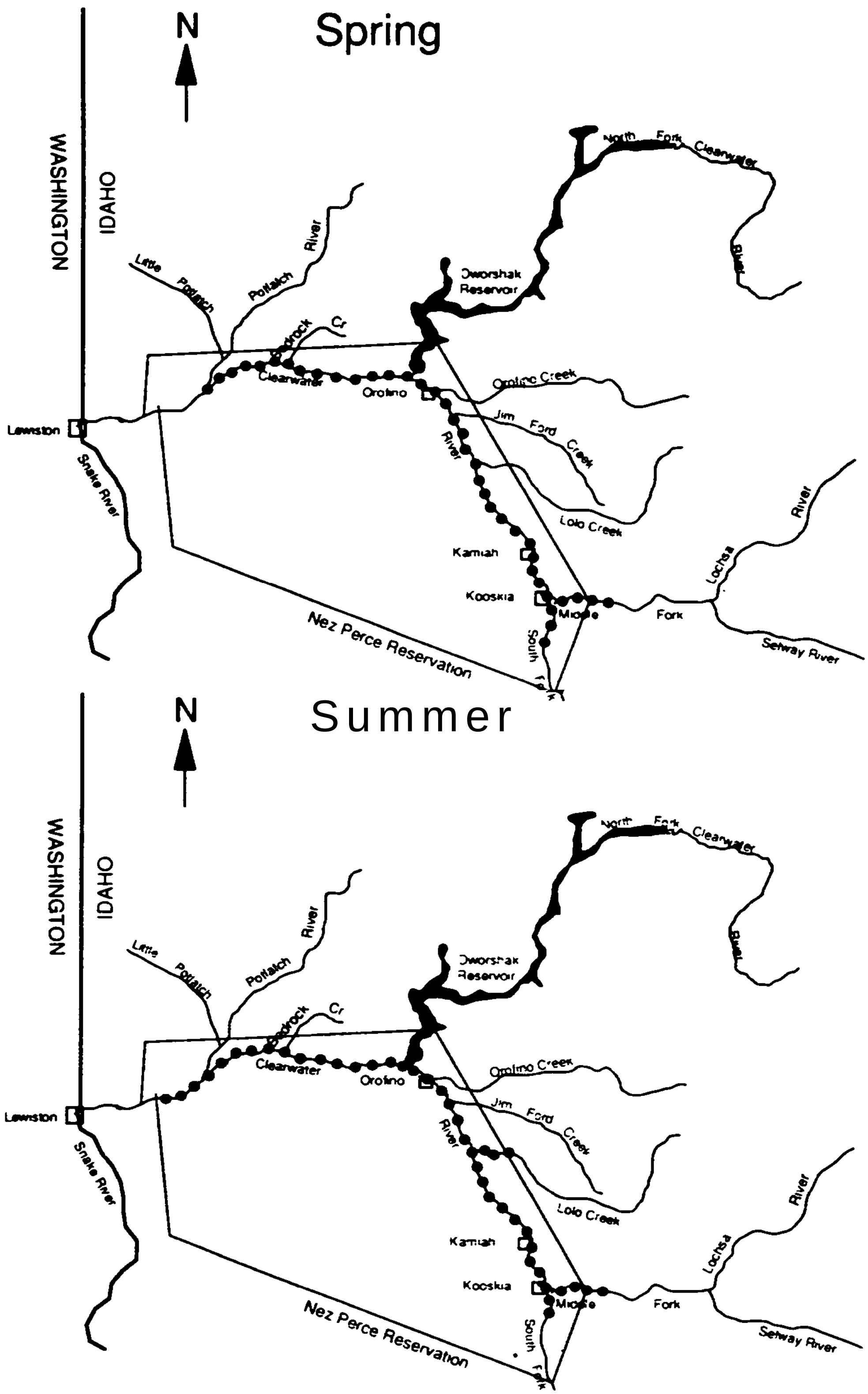


Appendix E-11. Map showing spring and summer home ranges of adult female otter F9, trapped in the Clearwater River, 1992.

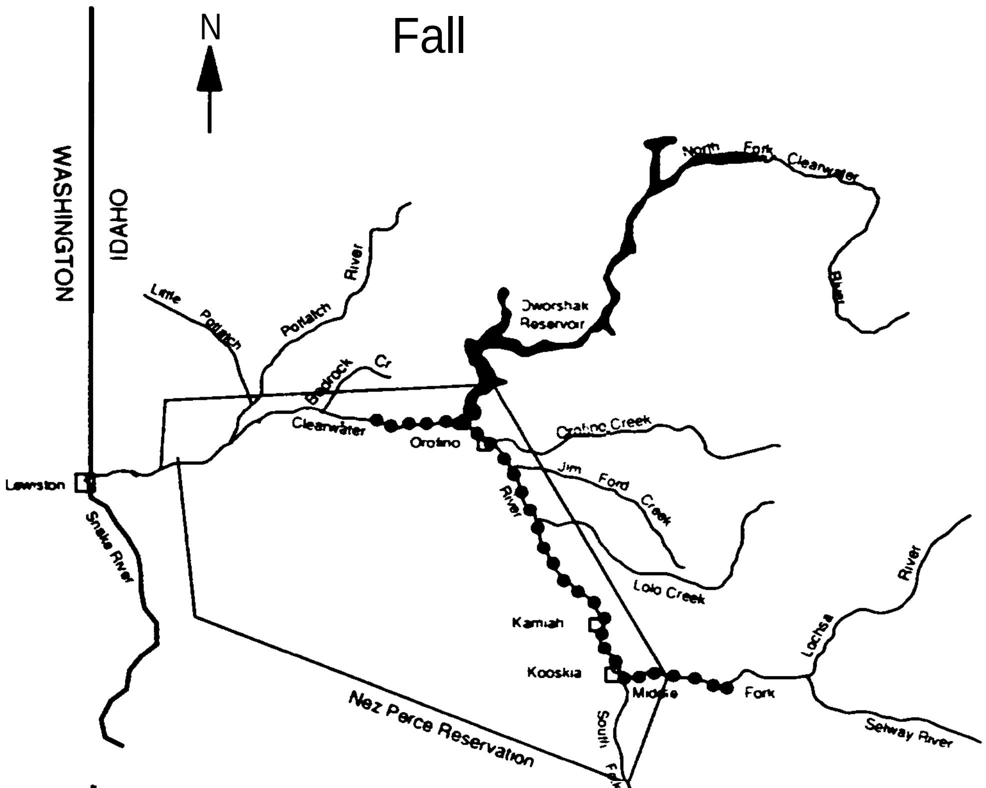


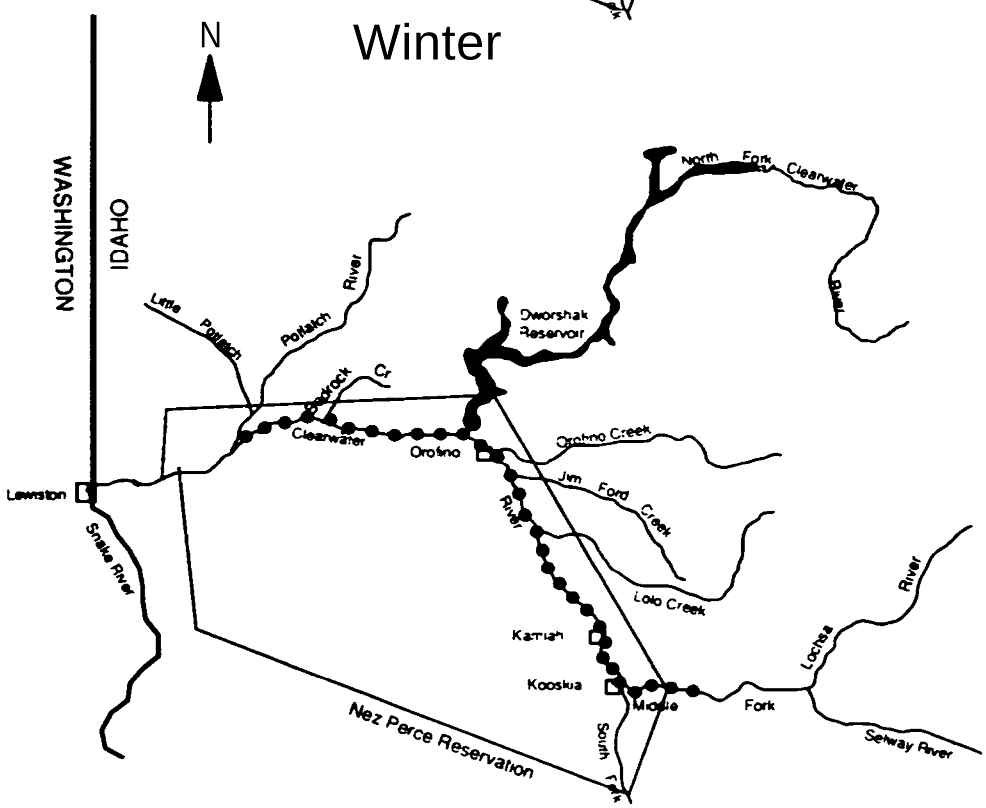


Appendix E-12. Map showing fall and winter home ranges of adult female otter F9, trapped in the Clearwater River, 1992.

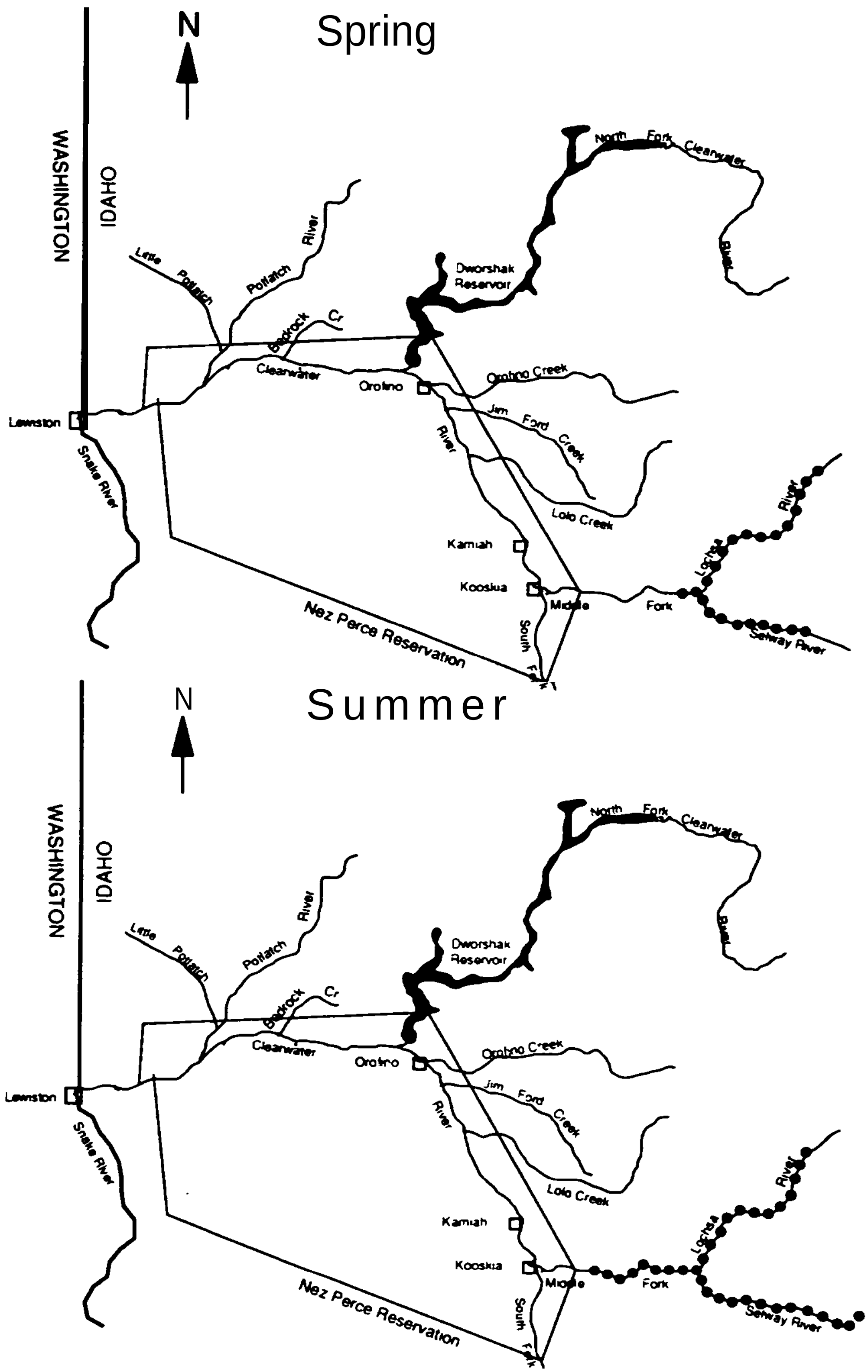


Appendix E.-13. Map showing spring and summer home ranges of adult male otter M11, trapped in the Clearwater River, 1992.

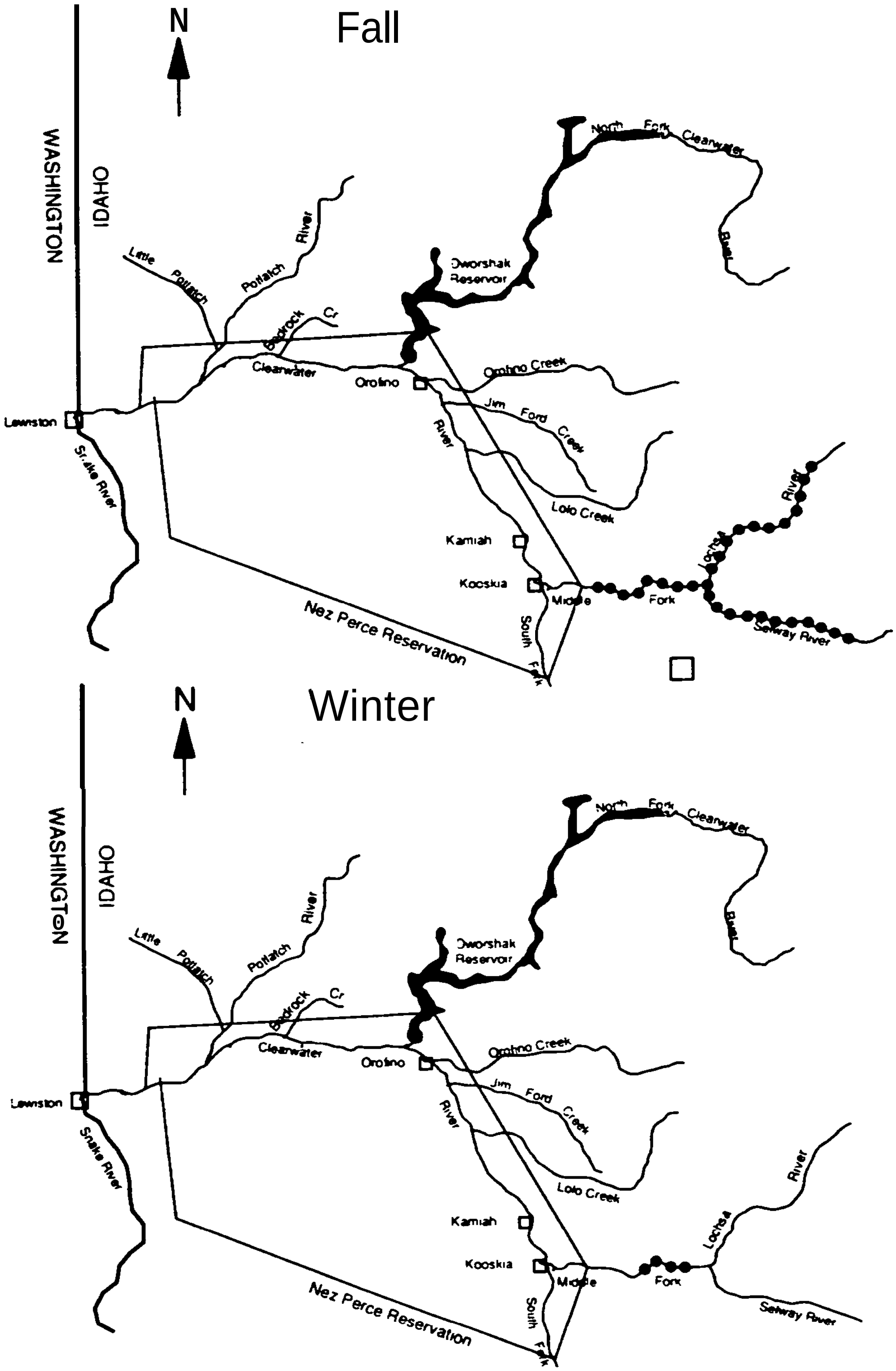




Appendix E-14. Map showing fall and winter home ranges of adult male otter M11, trapped in the Clearwater River, 1992.



Appendix E-15. Map showing spring and summer home ranges of adult male otter M12, trapped in the Clearwater River, 1992.



Appendix E-16. Map showing fall and winter home ranges of adult male otter M12, trapped in the Clearwater River, 1992.

APPENDIX

F

Habitat variables measured along the Clearwater River, Idaho 1991-92

Appendix F. Habitat variables measured in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Abbreviation	Description/Codes
BVR	Beaver activity 1 - present 2 - absent
WWC	Water way category 1 - reservoir 2 - pond 3 - slough/side channel 4 - tributary 5 - main current
FLW	River flow 1 - eddy/pool 2 - rapids/riffle 3 - main current
COV1[a]/COV2[a]	Cover board reading (number of visible squares out of a total of 54) taken at 1.5 m (COV1[a]) and 4.5 m (COV2[a]) away from and perpendicular to shoreline.
SLOP1[a]/SLOP2[a]	Slope category for the slope of the bank, below (SLOP1[a]) and above (SLOP2[a]) the current waterline. 1 - 0-20% (flat) 2 - 21-45% 3 - 46-90% 4 - >90% (undercut)
LNDFRM[a]	Land form 1 - concave 2 - convex 3 - straight
DEPTH[a]	Depth, 1 meter from shoreline 1 - 0-50 cm 2 - 50-100 cm 3 - >100 cm

Appendix F. Habitat variables measured in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. (continued)

Abbreviation	Description/Codes
VEG	Bank Vegetation 100 - Tree Overstory 10 - Coniferous Stand 1 - dense shrub 2 - sparse shrub 3 - dense herb 4 - sparse herb 20 - Scattered Conifers 1 - dense shrub 2 - sparse shrub 3 - dense herb 4 - sparse herb 30 - Deciduous Stand 1 - dense shrub 2 - sparse shrub 3 - dense herb 4 - sparse herb 40 - Scattered Deciduous 1 - dense shrub 2 - sparse shrub 3 - dense herb 4 - sparse herb 50 - Mixed Stand 1 - dense shrub 2 - sparse shrub 3 - dense herb 4 - sparse herb 60 - Scattered Mixed 1 - dense shrub 2 - sparse shrub 3 - dense herb 4 - sparse herb 200 - Shrub Overstory 10 - Dense Shrub 1 - dense herb 2 - sparse herb 20 - Sparse Shrub 1 - dense herb 2 - sparse herb 300 - Herbaceous Overstory 10 - Dense Herb 20 - Sparse Herb 400 - Unvegetated 20 - Non Habitat (<25% canopy cover)

Appendix F. Habitat variables measured in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. (continued)

Abbreviation	Definition/Codes
BNK	Bank Substrate 1 - organic; unconsolidated particles predominately organic 2 - mud; unconsolidated particles predominately silt and clay 3 - sand; unconsolidated particles predominately sand 4 - gravel; loose unconsolidated particles <10 cm in diameter 5 - cobble; stabilized unconsolidated particles 10-30 cm in diameter 6 - natural rock; stabilized unconsolidated particles 30-200 cm in diameter 7 - natural boulder; stabilized unconsolidated particles >200 cm in diameter 8 - highway riprap small; artificially stabilized banks along highways and other roads where fill is <30 cm in diameter 9 - highway riprap large; artificially stabilized banks along highways and other roads where fill is 30-200 cm in diameter 10 - highway outcrop; artificially stabilized banks along highways and other roads where fill is >200 cm in diameter 11 - railroad riprap small; artificially stabilized banks along railroad where fill is <30 cm in diameter 12 - railroad riprap large; artificially stabilized banks along railroad where fill is 30-200 cm in diameter 13 - railroad outcrop; artificially stabilized banks along railroad fill is >200 cm in diameter

Appendix F. Habitat variables measured in the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92. (continued)

Abbreviation	Description/Codes
BNK	Bank Substrate 14 - other unnatural small 15 - other unnatural large 16 - consolidated bedrock 17 - unconsolidated rock; a mixture of different sized rocks held in a matrix of soil

[a] Additional variables measured at documented river otter latrine sites.

APPENDIX

G

Reclassifications of bank substrate and vegetation categories

Appendix G-1. BNK1 reclassification of bank substrate categories.

BNK1 Code	BNK1 Explanation	Bank substrate Collapsed Original Classification
1	Organic	Organic/mud
3	Sand	Sand
4	Gravel/cobble	Gravel/cobble
6	Natural rock	Natural rock
7	Natural boulder	Natural boulder/consolidated rock
8	Small riprap	Small highway riprap/small railroad riprap/small unnatural rock
9	Large riprap	Large highway riprap/large railroad riprap/large unnatural rock
10	Rock outcrop	Highway outcrop/railroad outcrop
17	Conglomerate	Conglomerate

Appendix G-2. BNK2 reclassification of bank substrate categories.

BNK2 Code	BNK2 Explanation	Bank substrate: Collapsed original classification
1	Organic/sand	Organic/mud/sand
4	Gravel/cobble	Gravel/cobble
6	Natural rock	Natural rock
7	Natural boulder	Natural boulder/consolidated rock
8	Small riprap	Small highway riprap/small railroad riprap/small unnatural rock
9	Large riprap	Large highway riprap/large railroad riprap/large unnatural rock
10	Rock outcrop	Highway outcrop/railroad outcrop

Appendix G-3. VEG1 reclassification of bank vegetation categories.

VEG1		Vegetation
Code	Explanation	Collapsed original classification
110	Tree overstorv	Coniferous stand-deciduous stand-mixed stand
101	Tree overstory/densc shrub	Coniferous stand-deciduous stand-mixed stand/dense shrub
102	Tree overstory/sparse shrub	Coniferous stand/deciduous stand/mixed stand/sparse shrub
103	Tree ovcrstory/dense herb	Coniferous stand/deciduous stand/mixed stand/dense herb
104	Tree overstory/sparse herb	Coniferous stand/deciduous stand/mixed stand/sparse herb
120	Scattered tree overstory/	Coniferous scattered-deciduous scattered-mixed scattered
121	Scattered tree overstory/ dense shrub	Coniferous scattered-deciduous scattered-mixed scattered/dense shrub
122	Scattered tree overstory/ sparse shrub	Coniferous scattered-deciduous scattered-mixed scattered/sparse shrub
123	Scattered tree overstory/ dense herb	Coniferous scattered-deciduous scattered-mixed scattered/dense herb
124	Scattered tree overstory/ sparse herb	Coniferous scattered-deciduous scattered-mixed scattered/sparse herb
210	Dense shrub overstory	Dense shrub overstory
211	Dense shrub overstory/ dense herb	Dense shrub overstory/dense herb
23%	Dense shrub overstory/ sparse herb	Dense shrub overstory/sparse herb
220	Sparse shrub overstory	Sparse shrub overstory
221	Sparse shrub overstory/ dense herb	Sparse shrub overstory/dense herb
222	Sparse shrub overstory/ sparse herb	Sparse shrub overstory/sparse herb
310	Dense herb over-story	Dense herb overstory
320	Sparse herb over-story	Sparse herb overstory
400	Unvegetated 0% canopy cover	Unvegetated 0% canopy cover
420	Unvegetated O-258 canopy cover	Unvegetated O-258 canopy cover

Appendix G-4. VEG2 reclassification of bank vegetation categories.

VEG2		Vegetation
Code	Explanation	Collapsed original classification
100	Tree overstory	Coniferous stand-deciduous stand-mixed stand-coniferous scattered-deciduous scattered-mixed scattered
210	Tree overstory/dense shrub	Coniferous stand-deciduous stand-mixed stand-coniferous scattered-deciduous scattered-mixed scattered/dense shrub
220	Tree overstory/sparse shrub	Coniferous stand/deciduous stand/mixed stand-coniferous scattered-deciduous scattered-mixed scattered/sparse shrub
310	***Tree*** overstory/dense herb	Coniferous stand/deciduous stand/mixed stand-coniferous scattered-deciduous scattered-mixed scattered/dense herb
320	Tree overstory/sparse herb	Coniferous stand/deciduous stand/mixed stand-coniferous scattered-deciduous scattered-mixed scattered/sparse herb
221	Dense shrub overstory	Dense shrub overstory-dense herb/dense shrub overstory-sparse herb/sparse shrub overstory/dense herb
222	Sparse shrub overstory/sparse herb	Sparse shrub overstory/sparse herb
310	Dense herb overstory	Dense herb overstory
320	Sparse herb overstory	Sparse herb overstory
400	Unvegetated	Unvegetated 0% canopy cover/unvegetated 0-25% canopy cover

Appendix

H

River otter den sites documented in the Clearwater River, Idaho 1991-92.

Appendix H. River otter den sites documented in the Clearwater River, Idaho, 1991-92.

Name	Code	Reach	Location UTMN	Location UTME
Hatwai Riprap	01	LMCR[a]	5141580	506450
Drift	02	LMCR	5145180	516520
Arrow	03	LMCR	5146120	517290
Zan's	04	UMCR[b]	5141600	560860
Greer Hwy. Sign	05	UMCR	5137970	563050
Koo Sewage	06	MFCR[c]	5110930	579690
Dale's Cashway	07	UMCR	5114340	577230
Third Drop	08	UMCR	5129260	566610
Green House	09	UMCR	5146450	557630
Three LS	10	LMCR	5149730	547000
Redhearts	11	LMCR	5150410	537440
Lenore Bridge	12	LMCR	5150300	534330
Spalding Bridge	13	LMCR	5143160	512300
Lower Big Myrtle	14	LMCR	5148680	521160
Pardee	15	UMCR	5126340	568040
Upper Big Myrtle	16	LMCR	5149590	521650
Harper's Bend	17	LMCR	5148520	541740
Clearwater Co.	18	LMCR	5149880	549630
Lower Kamiah RR	19	UMCR	5122520	573360
Railroad House Kam	20	UMCR	5122820	572150
Redneck	21	UMCR	---	---
Maggie Creek	22	MFCR	5110230	581810
Mile Marker 83	23	MFCR	5110990	590010
Mike's Latrine	24	UMCR	5131360	565770
Orofino Airport	25	UMCR	5149000	555730
Pine Creek NE	26	LMCR	5152420	528050
Middle Fork PTCH	27	PTCH[d]	5159150	523260
Potlatch Crib	28	LMCR	5141380	504470
Arrow Bridge North	29	LMCR	5146340	517650
Arrow Bridge South	30	LMCR	5146300	517810
Carson's South	31	LMCR	5144630	516550
Five Mile	32	UMCR	5133430	564840
Slickpoo	33	PTCH	5152980	521100
HTM Slough	34	UMCR	5117930	576620
Little Myrtle	35	LMCR	5147470	518760
Latah/NP Co.	36	PTCH	5154020	521520
The Rock	37	UMCR	5116650	575620
Albright's	38	PTCH	5148970	518260
Red Elk	39	PTCH	5152420	520870
Lwr. PTCH Big Bend	40	PTCH	5151850	519460
Tramway Reserve	41	UMCR	5124040	569930
Lolo Cr. South	42	UMCR	5135210	564160
BM Old Bridge	43	LMCR	5149030	520760
Spalding Train Br.	44	LMCR	5143880	515060
Elderberry	45	PTCH	5150900	519150
Cash	46	PTCH	5151620	520760
Suttler Creek	47	MFCR	5110250	589270
Coyote Creek	48	MFCR	5111020	583780
Old Schoolhouse	49	PTCH	5151450	520480

Appendix H. River otter den sites documented in the Clearwater River, Idaho, 1991-92 (continued).

Name	Code	Reach	Location UTMN	UTME
BM Old Bridge	50	LMCR	5148940	520920
Weaskus	51	PTCH	5149470	518680
Juliaetta Sewage	52	PTCH	5156320	522420
Galloway	53	PTCH	5153350	521190
Bramer	54	PTCH	5161060	525460
Osprey 3 West	55	UMCR	5136250	563440
Beehive	56	PTCH	5154200	521720
Railroad Cut 1	57	LMCR	5149290	541060
Doc Little	58	PTCH	5160030	524390
Six Mile Rapid	59	UMCR	5128410	567100
Tramway Rapid	60	UMCR	5125190	569560
Green Knob	61	PTCH	5157800	516700
Shack	62	PTCH	5149260	518340
Boot	63	PTCH	5151660	519470
Creischer	64	PTCH	5160160	524380
Culvert	65	LMCR	5146380	517610
Williams'	66	PTCH	5148000	518380
K. Golf C.	67	PTCH	5163700	529060
Ken. Shack	68	PTCH	5162020	527430
Slick Rock	69	PTCH	5165650	533870
Ceadar Creek	70	PTCH	5165610	533870
Camp T	71	LMCR	5149600	539780
Cherry Slough	72	LMCR	5151200	525020
Island	73	MFCR	5111250	584600
Cottonwood	74	SFCR	5102800	579350
Pine Knob	75	SFCR	5102840	579330
Kooskia Gravel	76	UMCR	5111020	577450
Kerby's	77	LMCR	5151230	525210
Larson West	78	PTCH	5153000	521240
IDT Pond	79	LMCR	5145420	516630
Kamp 0	80	LMCR	5149990	549180
East Res. Blckbrry	81	MFCR	5111140	584860
Syringa Undercut V	82	MFCR	5110600	599550
Gibbs' Fruit Stand	83	LMCR	5144210	516080
Below Dead Stump	84	LOCH'	5121940	623200
Corner Flat Rock	85	LOCH	5116590	612360
Flat Round Rock	86	SELW	5104420	618090
Pea Field	87	PTCH	5152810	521030
Old Snag	88	SELW	5107150	610590
Fenn Island	89	SELW	5104790	613260
Fenn Sewer	90	SELW	5105480	612640
Fenn Ranger	91	SELW	5105780	612290
Split Rock	92	LOCH	5120000	616110
Fire Creek	93	LOCH	5120220	620980
Cat Creek	94	LOCH	5114620	610450
Eel Creek	95	LOCH	5130950	626810
Cliff	96	LOCH	5119280	613350

Appendix H. River otter den sites documented in the Clearwater River, Idaho, 1991-92 (continued).

Name	Code	Reach	Location UTMN	Location UTME
Post Rock	97	SELW	5101600	629550
North Fork	98	NFCR[h]	5150910	553790
Big Canyon	100	LMCR	5149400	543500
Snowshoe	101	LOCH	5128420	625480
Rock Island	102	SELW	5104180	621960
Big Hill Rapid	103	MFCR	5109900	601540
Broken Tree	104	PTCH	5150460	518700
Sheep Creek	105	PTCH	5196500	546800
Stites Slough	106	SFCR	5105350	579160
Blue House	107	PTCH	5192630	546260
White Trailer	108	PTCH	5158710	523000
Bobo's	109	LMCR	5152090	529520
MM93	110	MFCR	5109980	602720
East Fk. Log Jam	111	PTCH	5187380	546490
Mossy Rock	112	SELW	5101620	629590
Round Rock	113	NFCR	5150650	553400
Wing's Mailbox	114	PTCH	5147140	517880
Kerr Creek	115	LOCH	5113390	610990
Concrete	116	PTCH	5155240	521860
BPA	117	LMCR	5141950	501880
R&R Mobile Home	118	PTCH	5156540	522280
Landry's	119	SELW	5105190	613950
Two Shadows	120	MFCR	5110090	602800
No. 1 Creek MM 89	121	MFCR	5109990	597470
Bob's	122	LMCR	5149290	542300
Bridge Creek	123	MFCR	5109820	604170
MM 11	124	PTCH	5160870	525080
Cedar Log	125	SELW	5104310	618210

[a] LMCR - Lower mainstem Clearwater River from its mouth at Lewiston upstream to its confluence with the North Fork Clear-water River at Orofino.

[b] UMCR - Upper mainstem Clearwater River from the confluence of the North Fork Clearwater River at Orofino upstream to its confluence with the South Fork Clearwater River at Kooskia.

[c] MFCR - Middle Fork Clearwater River from the confluence of the South Fork Clearwater River at Kooskia upstream to its confluence with the Lochsa and Selway Rivers at Lowell.

[d] PTCH - Potlatch River at its mouth upstream to Bovill.

[e] SFCR - South Fork Clear-water River from its mouth at Kooskia upstream to Harpster.

[f] LOCH - Lochsa River from its mouth at Lowell upstream to the confluence of Fish Creek.

[g] SELW - Selway River from its mouth at Lowell upstream to the confluence of Meadow Creek.

[h] NFCR - North Fork Clearwater River from its mouth at Orofino upstream to Dworshak Dam.

APPENDIX

I

Frequency tables for habitats associated with river otter denning sites used by otters captured in the Clearwater River, Idaho 1992

Appendix I-l. Frequency, percent, and cumulative percent of the most common (variable categories accounting for 80% of all observed use) bank vegetation and bank substrates classified at den sites used by instrumented river otters along the entire Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Habitat variable/category	Frequency	%	Cumulative %
Bank vegetation			
Unvegetated-0% canopy cover	313	35.7	35.7
Unvegetated-O-25% canopy cover	110	12.6	48.3
Shrub overstory-sparse shrub-sparse herb	97	11.1	59.4
Shrub overstory-sparse shrub	57	6.5	65.9
Shrub Overstory-sparse shrub-dense herb	50	5.7	71.6
Shrub overstory-dense shrub-sparse herb	39	4.5	76.1
Tree overstory-deciduous stand-dense shrub	33	3.8	79.9
Tree overstory-scattered deciduous-sparse shrub	25	2.9	82.8
Bank substrate			
Large railroad riprap	263	30.0	30.0
Large highway riprap	203	23.2	53.2
Natural rock	122	13.9	67.1
Organic	74	8.4	75.5
Natural boulder	56	6.4	81.9

Appendix 1-2. Frequency, percent, and cumulative percent of the most common (variable categories accounting for 80% of all observed use) combined bank vegetation/bank substrate and flow/waterway category/beaver sign variables classified at den sites used by instrumented river otters along the entire Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Combined habitat variable/category	Frequency	%	Cumulative %
Bank vegetation/bank substrate			
Unvegetated-0% canopy cover/large highway riprap	93	12.5	12.5
Unvegetated-0% canopy cover/large railroad riprap	67	9.0	21.5
Shrub overstory-sparse shrub-sparse herb/large railroad riprap	60	8.0	29.5
Shrub overstory-sparse shrub/large highway riprap	52	7.0	36.5
Unvegetated-OX canopy cover-,/natural rock	45	6.1	42.6
Unvegetated-0-25% canopy cover/natural rock	34	4.6	47.2
Unvcgetated-O-25% canopy cover/large highway riprap	31	4.2	51.4
Unvegetated-0% canopy cover/railroad outcrop	29	3.9	55.3
Unvegetated-0% canopy cover/natural boulder	25	3.4	58.7
Tree overstory-deciduous stand-dense shrub/organic	25	3.4	62.1.
Shrub overstory-dense shrub-sparse herb/large railroad riprap	25	3.4	65.5
Unvegetated-O-253 canopy cover/large railroad riprap	21	2.8	68.3
Shrub ovcrstory-sparse shrub-dense herb/highway outcrop	20	2.7	71.0
Tree overstory-scattered deciduous-sparse shrub/large railroad riprap	18	2.4	73.4
Unvcgetated-0% canopy cover/other large unnatural	16	2.2	75.6
Shrub overstory-sparse shrub-dense herb/large railroad riprap	15	2.0	77.6
Tree overstory-scattered deciduous-dense shrub/large railroad riprnp	13	1.8	79.4
Herbaceous overstory-dense herb/mud	12	1.6	81.0
Flow/waterway category/beaver sign			
Flow-main current/mainstem/beaver sign-absent	397	53.4	53.4
Plow--eddy-pool/mainstem/beaver sign-absent	116	15.6	69.0
Flow-rapids-riffle/mainstem/beaver sign-absent	60	8.1	'77.1
Flow-eddy-pool/mainstem/beaver sign-present	48	6.5	83.6

Appendix I-3. Frequency, percent, and cumulative percent of the most common (variable categories accounting for 80% of all observed use) bank vegetation and bank substrates classified at den sites used by instrumented river otters along the lower Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Habitat variable/category	Frequency	%	Cumulative %
Bank vegetation			
Unvegetated-0% canopy cover	152	43.1	43.1
Unvegetated-O-258 canopy cover	59	17.5	60.6
Shrub overstory-sparse shrub-sparse herb	51	15.1	75.7
Shrub overstory-sparse shrub	22	6.5	82.2
Bank substrate			
Large highway riprap	94	27.9	27.9
Large railroad riprap	91	27.0	54.9
Natural rock	58	17.2	72.1
Organic	27	8.0	80.1

Appendix I-4. Frequency, percent, and cumulative percent of the most common (variable categories accounting for 80% of all observed use) combined bank vegetation/bank substrate and flow/waterway category/beaver sign variables classified at den sites used by instrumented river otters along the lower Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Combined habitat variable/category	Frequency	%	Cumulative %
Bank vegetation/substrate			
Unvegetated-0% canopy cover/large highway riprap	68	**20.2**	20.2
Unvegetated-0% canopy cover/large railroad riprap	52	**15.3**	35.5
Shrub overstory sparse shrub-sparse herb/large railroad riprap	39	11.6	47.1
Unvegetated-0 25% canopy cover/natural rock	33	9.8	56.9
Unvegetated 0 25% canopy cover/large highway riprap	26	7.7	64.6
Shrub overstory sparse shrub-dense herb/highway outcrop	20	5.9	70.5
Unvegetated-0% canopy cover/natural rock	18	5.3	75.8
Tree overstory-deciduous stand-dense shrub/organic	18	5.3	81.1
Flow/waterway category/beaver sign			
Flow-main current/mainstem/beaver sign-absent	201	59.6	59.6
Flow-eddy-pool/mainstem/beaver sign-absent	60	17.8	77.4
Flow-eddy-pool/mainstem/beaver sign-present	28	8.3	85.7

Appendix I-5. Frequency, percent, and cumulative percent of the most common (variable categories accounting for 80% of all observed use) bank vegetation and bank substrates classified at den sites used by instrumented river otters along the upper Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Habitat variable/category	Frequency	%	Cumulative %
Bank vegetation			
Unvegetated-0% canopy cover	98	41.9	41.9
Shrub overstory-sparse shrub	53	22.7	64.6
Shrub overstory-sparse shrub-sparse herb	23	9.8	74.4
Tree ovcrstory-scattered deciduous-sparse shrub	18	7.7	82.1
Unvegetated-0-25% canopy cover	18	7.7	89.8
Bank substrate			
Large highway riprap	83	35.5	35.5
Large railroad riprap	65	27.U	63.3
Railroad outcrop	29	12.4	75.7
Natural rock	25	10.7	86.4

Appendix I-6. Frequency, percent, and cumulative percent of the most common (variable categories accounting for 80% of all observed use) combined bank vegetation/bank substrate and combined flow/waterway category/beaver sign variables classified at den sites used by instrumented river otters along the upper Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Combined habitat variable/category	Frequency	%	Cumulative %
Hank vegetation/substrate			
Shrub overstory-sparse shrub/large highway riprap	52	22.2	22.2
Unvegetated-0% canopy cover/railroad outcrop	29	12.4	34.6
Unvegetated-0% canopy cover/large highway riprap	24	10.3	44.9
Unvcgetatcd-0% canopy cover/natural rock	21	9.0	53.9
Unvegetated-0-25% canopy cover/large railroad riprap	18	7.7	61.6
Tree overstory-scattered deciduous-sparse shrub/large railroad riprap	18	7.7	69.3
Shrub overstory-sparse shrub-sparse herb/large railroad riprap	16	6.8	76.1
Unvegetated-0% canopy cover/large railroad riprap	12	5.1	81.2
Flow/waterway category/beaver sign			
Flow-main current/mainstem/beaver sign-absent	164	70.1	70.1
Flow-rapids-riffle/mainstem/beaver sign-absent	38	16.2	86.3

Appendix I-7. Frequency, percent, and cumulative percent of the most common (variable categories accounting for 80% of all observed use) bank vegetation and bank substrates classified at den sites used by instrumented river otters along the Potlatch River, a tributary of the Clearwater River, within the Nez Perce Indian Reservation, Idaho, 1991-92.

Habitat variable/category	Frequency	%	Cumulative %
Bank vegetation			
Shrub overstory--dense shrub-sparse herb	31	25.6	25.6
Shrub overstory-sparse shrub-dense herb	18	14.9	40.5
Tree overstory--scattered deciduous-dense shrub	15	12.4	52.9
Shrub overstory-sparse shrub-sparse herb	11	9.1	62.0
Tree overstory-deciduous stand-dense herb	9	7.4	69.4
Shrub overstory-dense shrub-dense herb	8	6.6	76.0
Tree over-story-deciduous stand-dense shrub	7	5.8	81.8
Bank substrate			
Large railroad riprap	79	79.0	79.0
Organic	19	15.7	94.7

Appendix I-8. Frequency, percent, and cumulative percent of the most common (variable categories accounting for 80% of all observed use) combined bank vegetation/ bank substrate and flow/waterway category/beaver sign variables classified at den sites used by instrumented river otters along the Potlatch River, a tributary of the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

Combined habitat variable/category	Frequency	%	Cumulative %
Bank vegetation/substrate			
Shrub overstory-dense shrub-sparse herb/large railroad riprap	25	20.7	20.7
Shrub overstory-sparse shrub-dense herb/large railroad riprap	15	12.4	33.1
Tree over-story-scattered deciduous-dense shrub/large railroad riprap	13	10.7	43.H
Tree overstory-deciduous stand-dense herb/organic	9	1.4	51.2
Shrub overstory-dense shrub-dense herb/large railroad riprap	8	6.6	57.8
Tree overstory-deciduous stand-dense shrub/organic	7	5.8	63.6
Shrub overstory-sparse shrub-sparse herb/large railroad riprap	5	4.1	67.7
Herbaceous overstory-dense herbaceous/large railroad riprap	4	3.3	71.0
Shrub overstory-dense shrub-sparse herb/natural rock	3	3.3	74.3
Shrub overstory-sparse shrub-dense herb/organic	3	2.5	76.8
Shrub overstory-sparse shrub-sparse herb/large highway riprap		2.5	79.3
Unvegetated-OK canopy cover/large railroad riprap	3	2.5	81.8
Unvegetated-O-258 canopy cover/large railroad riprap	3	2.5	84.3
Flow/waterway category/beaver sign			
Flow-eddy--pool/slough-side channel/beaver sign-absent	30	24.8	24.8
Flow-eddy-pool/mainstem/beaver sign-absent	24	19.8	44.6
Flow-main current/mainstem/beaver sign-absent	21	17.4	62.0
Flow-eddy-pool/slough-side channel/beaver sign-present	16	13.2	75.2
Flow-rapids-riffle/mainstem/beaver sign-absent	12	9.9	85.1

Appendix J. Number of sites (n) and Proportions (%) for categories of habitat variables measured at 29 documented river otter latrine sites in the lower and upper river sections of the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92.

	River Section					
	Lower		Upper		Study area	
Habitat variable/category	n	%	n	%	n	%
Beaver activity						
1 - present	18	62.07	13	61.90	31	62.00
2 - absent	10	34.48	5	23.81	15	30.00
9 - unknown	1	3.45	3	14.29	4	8.00
Water way category						
1 - reservoir	0	0.0	0	0.0	0	0.0
2 - pond	0	0.0	0	0.0	0	0.0
3 - sloughiside channel	10	34.48	C	0.0	10	20.00
4 - tributary	0	0.0	0	0.0	0	0.0
5 - mainstem	18	62.07	18	85.71	36	72.00
9 - unknown	1	3.45	3	14.29	4	8.00
River flow						
1 - eddy/pool	21	72.41	12	57.14	33	66.00
2 - rapids/riffle	3	10.34	1	4.76	4	8.00
3 - mainstem	4	13.79		23.81	9	18.00
9 - unknown	1	3.45	5	14.76	4	8.00
Bank cover (Cov1)a						
1 - G-13 squares	0	0.0	1	4.76	1	2.00
2 - 14-26 squares	1	3.45	2	9.52	3	6.00
3 - 27-39 squares	7	24.14	5	23.81	12	24.00
4 - 40-54 squares	1	65.52	10	47.62	29	58.00
9 - unknown	2	6.90	3	14.29	5	10.00
Bank cover (Cov2)b						
1 - O-13 squares	i	3.45	0	0.0	1	2.00
2 - 14-26 squares	0	0.0	0	0.0	0	0.0
3 - 27-39 squares	2	6.90	3	14.29	5	10.00
4 - 40-54 squares	23	79.31	14	66.67	37	74.00
9 -	3	10.34	4	19.05	7	14.00
Slope (SLOP1)c						
1 - 0-20% (flat)	19	65.52	13	61.90	32	64.00
2 - 21-45%	9	31.03	3	14.29	12	24.00
3 - 46-90%	0	0.0	2	9.52	2	4.00
4 - >90% (undercut)	0	0.0	0	0.0	0	0.0
9 - unknown	1	3.45	3	14.29	4	8.00
Slope (SLOP2)d						
1 - 0-20% (flat)	2	6.90	4	19.05	6	12.00
2 - 21-45%	14	48.28	11	52.38	25	50.00
3 - 46-90%	ii	37.93	3	14.29	14	28.00
4 - >90% (undercut)	1	3.45	0	0.0	1	2.00
9 - unknown	1	3.45	3	14.29	4	8.00
Land form						
1 - concave	3	10.34	4	19.05	7	14.00
2 - convex	18	62.07	8	38.10	26	52.00
3 - straight	7	24.14	6	28.57	13	26.00
9 - unknown	1	3.45	3	14.29	4	8.00
Depth, 1 meter from shoreline						
l - o-50 cm	17	58.62	12	57.14	29	58.00
2 - 50-100 cm	3	10.34	3	14.29	6	12.00
3 - >100 cm	8	27.59	3	i4.29	li	22.00
9 - unknown	1	3.45	3	14.29	4	8.00

Appendix J. Number of sites (n) and Proportions (%) for categories of habitat variables measured at 29 documented river otter latrine sites in the lower and upper river sections of the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92 (continued).

Habitat variable/category	River section Lower n	%	Upper n	%	Study area n	%
Bank vegetation						
100 - Tree Overstory	0	0.0	0	0.0	0	0.0
10 - Coniferous Stand	O	0.0	0	0.0	0	0.0
1 - dense shrub	O	0.0	0	0.0	0	0.0
2 - sparse shrub	O	0.0	0	0.0	0	0.0
3 - dense herb	O	0.0	0	0.0	0	0.0
4 - sparse herb	0	0.0	0	0.0	C	0.0
20 - Scattered Conifers	0	0.0	0	0.0	0	0.0
1 - dense shrub	0	0.0	0	0.0	0	0.0
2 - sparse shrub	0	0.0	0	0.0	0	0.0
3 - dense herb	0	0.0	0	0.0	0	O.C
4 - sparse herb	0	0.0	0	0.0	0	0.0
30 - Deciduous Stand	0	0.0	0	0.0	0	0.0
1 - dense shrub	0	0.0	0	0.0	0	0.0
2 - sparse shrub	0	0.0	0	0.0	0	0.0
3 - dense herb	' 1	3.45	2	9.52	2	6.00
4 - sparse herb	1	3.45	0	0.0	0	2.00
40 - Scattered Deciduous	0	0.0	0	0.0	0	0.0
1 - dense shrub	2	6.90	0	0.0	2	4.00
2 - sparse shrub	1	3.45	0	0.0	1	2.00
3 - dense herb	0	0.0	2	9.52	2	4.00
4 - sparse herb	0	0.0	1	4.76	1	2.00
50 - Mixed Stand	0	0.0	0	0.0	0	0.0
1 - dense shrub	0	0.0	0	0.0	0	0.0
2 - sparse shrub	0	0.0	1	4.76	1	2.00
3 - dense herb	0	0.0	0	O.0	0	0.0
4 - parse herb	1	3.45	0	O.0	1	2.00
60 - Scattered Mixed	0	0.0	0	0.0	0	0.0
1 - dense shrub	0	0.0	0	0.0	0	0.0
2 - sparse shrub	1	3.45	0	0.0	1	2.00
3 - dense herb	0	0.0	0	0.0	0	0.0
4 - sparse herb	0	0.0	0	0.0	0	0.0
200 - Shrub Overstory	G	0.0	0	0.0	0	0.0
10 - Dense Shrub	0	0.0	0	0.0	C	0.0
1 - dense herb	1	3.45	2	9.52	3	6.00
2 - sparse herb	1	3.45	1	4.76	2	4.00
20 - Sparse Shrub	0	0.0	0	0.0	0	0.0
1 - dense herb	3	10.34	2	9.52	5	10.00
2 - sparse herb	7	24.14	2	9.52	9	18.00
300 - Herbaceous Overstory	0	C.0	0	0.0	0	0.0
10 - Dense Herb	1	3.45	2	9.52	3	6.00
20 - Sparse Herb	2	6.90	0	0.0	2	4.00
400 - Unvegetated	3	10.34	2	9.52	5	10.00
20 - Non Habitat (<25% canopy cover)	3	10.34	1	4.76	4	8.00
999 - unknown	i	3.45	3	14.29	4	8.00

Appendix J. Number of sites (n) and Proportions (%) for categories of habitat variables measured at 29 documented river otter latrine sites in the lower and upper river sections of the Clearwater River within the Nez Perce Indian Reservation, Idaho, 1991-92 (continued).

	River section					
	Lower		Upper		Study area	
Habitat variable/category	n	%	n	%	n	%
Bank substrate						
1 - organic	4	13.79	0	0.0	4	8.00
2 - mud	1	3.45	0	0.0	1	2.00
3 - sand	8	27.59	5	23.81	13	26.00
4 - gravel	1	3.45	0	0.0	1	2.00
5 - cobble	0	0.0	0	0.0	0	0.0
6 - natural rock	0	0.C	0	0.0	0	0.0
7 - natural boulder	1	3.45	2	9.52	3	6.00
8 - highway riprap small	0	0.0	0	0.0	0	0.0
9 - highway riprap large	3	10.34	3	14.29	6	12.00
10 - highway outcrop	0	0.0	0	0.0	0	0.0
11 - railroad riprap small	1	3.45	1	4.76	2	4.00
i2 - railroad riprap large	6	20.69	4	19.05	10	20.00
13 - railroad outcrop	0	0.0	0	0.0	0	0.0
14 - other unnatural small	0	0.0	0	0.0	0	0.0
15 - other unnatural large	2	6.90	0	0.0	2	4.00
16 - consolidated bedrock	0	0.0	0	0.0	0	0.0
17 - unconsolidated rock	1	3.45	3	14.29	4	8.00
99 - unknown	1	3.45	3	14.29	4	8.00